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THE LIFE AND WORK OF TOM IREDALE (1880-1972)

by

GILBERT P. WHITLEY

(Plate V.)

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BIOGRAPHY

To try to describe a man's life and work: so much is elusive—it is like picking up quicksilver with one's fingers.

The subject of this memorial tribute, my old friend Tom Iredale, was quite unlike anyone else I have known. To do justice to his many-sided nature is quite impossible, yet something must be recorded, however imperfectly, in our swiftly moving times, for the sake of the history of science, particularly of the systematic study of Australasian zoology to which he contributed so much in his long lifetime that he has been termed "Australia's Linnaeus". Perhaps the best plan is to set down my notes and recollections in chronological order.

Early days

Tom Iredale was born at Workington, Cumberland, England on March 24th 1880. He was the eighth of a family of nine children, all his brothers and sisters predeceasing him. His father was John Iredale and his mother had been a Miss Wilkinson. He was christened Tom (after a ship of that name), not Thomas⁽¹⁾.

In his boyhood, Tom actively climbed trees and mountains, played football and wrestled (in the Cumberland and Westmorland style) with his mates. He was always interested in birds, their eggs and nests, and read every book he could find on natural history in his grandfather's library, copying out extracts or even whole books on birds and making lists, in his childhood, which foreshadowed those which were to occupy his later years. At the age of 17, he was stricken by some kind of tubercular affliction (the marks from which on the right side of his throat persisted through life) so he was forced to spend a year lying down, or very restricted in his movements as a chronic invalid. Tom's schooling was therefore informal, partly from tutors, mainly by extensive reading, and he never matriculated or became an undergraduate of any university. The result was a fierce independence of thought, devastating critical faculties, and sometimes a rather scornful

⁽¹⁾ Bibliographers and librarians should not therefore confuse him with another Sydney-based scientist, Dr. Thomas Iredale (1879-1971), author of papers in the field of physical chemistry, and a son of Frank Iredale, the famous cricketer.

attitude towards the more pompous academics. Towards the turn of the century, Iredale was apprenticed to a chemist and (characteristically, it seems) perused the British *Pharmacopoeia* with an eye to detecting faults or inconsistencies therein. However, the climate of the north of England was deemed too rigorous and he decided to seek a milder habitat. He could not have chosen a more distant clime, for he decided upon the Antipodes. At the age of 21, he cut all family ties and sailed for Australia and New Zealand in 1901, steaming to the Cape (where passengers were not allowed to land because of the Boer War) and into the roaring forties for Hobart where he arrived in January 1902, thence proceeding to Sydney, Wellington and Lyttelton, New Zealand. This heroic voyage was of benefit to our invalid; his constitution was fortified, his mettle high, and between the ages of 20 and 80 he was not to consult any doctors at all.

New Zealand period

Arrived at Christchurch, New Zealand, with only £5 to his credit, Iredale stayed with other youths at a cheap (eighteen shillings a week) boarding-house. He frequently had to lie down and rest, but was admired by his more robust and boisterous companions for his gameness and perseverance. Mr. Mark Steeds of Henry Berry & Co., noticed that Iredale was quick at figures and eager to learn and engaged him for that firm, which introduced a number of then novel business principles to New Zealand and which still flourishes on both sides of the Tasman Sea. Iredale worked for Henry Berry's for a number of years and spent his spare time rambling around Christchurch observing bird life. During weekends he went camping with Walter R. B. Oliver (then a Customs clerk, later a famous botanist and ecologist). They regretted that they could not hike or cycle to Kaikoura and other places, in those days too remote to reach: Sumner or the Akaroa Peninsula were the usual limits of their jaunts. Iredale's primary interest was the birds and their eggs, which were few in number, but Oliver introduced him to the fascinating study of the more numerous mollusca, with particular attention to ecology, then a novel subject. In 1904 or 1905, Iredale wrote to H. Leighton Kesteven at the Australian Museum, Sydney, regarding the protoconchs of shells, thereby starting a correspondence which was to lead to a lifelong friendship.

Iredale was one of the first persons to use the word 'ecological' in a zoological context (*Proc. Malac. Soc. London*, 10(6), Sept. 1913:364). He had derived it from Oliver's botanical work. The word 'ecology', now on everybody's lips, was used as 'Oecology' concerning animals and plants by Haeckel in 1873 (*Oxford English Dictionary*). He also coined neologisms such as ecomorphs, nannomorphs, etc.

The Kermadec Islands

One day, Oliver and Iredale unwrapped some newspaper around their picnic lunch and noticed an advertisement. It was to the effect that somebody was wanted for a trip to the Kermadec Islands and applicants were asked to write to a Mr. W. Wallace at Timaru. The two young men forthwith did so. Negotiations were protracted: Oliver and another friend hesitated, but Iredale said he would go alone with Wallace if necessary as he wished to see the birds of the Kermadecs, especially the new species which had been described by Captain F. W. Hutton, whom Iredale knew and who had commented favourably at the reading of Iredale's first paper, "On the occurrence in New Zealand of *Platalea regia*, Gould" (*Trans. N. Zeal. Inst.*, 39, 1907:137).

With a grant of £10 from the New Zealand Institute, which was thus to change their lives, Iredale and Oliver organised a small expedition to the Kermadec Islands where they camped for ten months (January to November, 1908). Mostly they were on Sunday (also called Raoul) Island, where the Bell family had settled, but they visited all the islands of the group. Tom's climbing skill from his Cumberland youth was restored in the rugged volcanic terrain and the isolation taught him self-reliance. Here his observations on petrels and other birds were not to be equalled by naturalists for many years

and were almost unheard of activities amongst cabinet ornithologists. Iredale also worked on tiny molluscs of land and sea, learning much from Roy Bell, a bushman and naturalist, born and settled on the Kermadecs, and who continued to collect and observe for Iredale for a long time afterwards. Articles and photographs of the Kermadec Islands which by now must be of historic importance were contributed by Iredale to New Zealand newspapers (See bibliography, *infra*, items 7A-E). A photograph of Iredale of those times shows him as long-haired and bearded (Plate V).

The Kermadec collections, including Iredale's shells (many of them type-specimens) went to the Museum at Christchurch, New Zealand, but some material is in the Australian Museum, Sydney.

First Caloundra visit

After the Kermadec trip, Iredale left New Zealand, intending to return to England. On the way, in 1908, he came to Sydney where the conchologist Charles Hedley (who was President of the Zoology Section of the Australian Association for the Advancement of Science) persuaded him to stay awhile for the A.A.A.S. Congress, held at Brisbane. Thus, in February 1909, Iredale visited Port Curtis and Caloundra, southern Queensland, collecting chitons and other molluscs (about 300 species) and he examined G. Gross's collection of Caloundra shells⁽²⁾ which later went to Sir Joseph Verco in Adelaide. He also experienced a "rain of fishes" rattling on a roof at Caloundra.

Resuming his voyage to England, he stayed for some time with a sister in Cairo. Back in Britain once more, he made a trip to Glasgow and the Trossachs in 1910.

His upbringing had been strict, in a Christian family, and it was not until he was 30 that he began going to such worldly places as theatre and vaudeville. Later he was to find "show business" and the persons associated with it a relaxation from the disciplines of science.

Donations to the Australian Museum

Tom Iredale's name first appears in the Australian Museum's Registers of Conchology as early as 1906 when he sent two *Cyclostrema* (No. C.25256) from Lyttelton. Other gifts of New Zealand shells followed, some collected by Iredale, some by H. Suter. In 1909 and in later years, shells from the Kermadec Islands, arrived (C.30150, 36618 and later entries). In 1913, shells collected by Iredale at Caloundra, Queensland (C.35103 etc.) are listed and a year later, probably after study at the British Museum, further Kermadecs and Caloundra shells are noticed. Later registers of course record the results of much further collecting by Tom Iredale.

British Museum (Natural History) associations

As a freelance worker, when identifying his Kermadec Islands birds at the British Museum (Natural History) in 1909, Iredale was told that a Mr. Mathews would like to see him. Both were then studying petrels and, in the event, they joined forces and Mathews (who like many ornithologists of that time was of independent means) engaged Iredale to help him produce his *Birds of Australia*, a monumental work, in the fashion of Gould, published between 1910 and 1927. Portraits of Mathews and Iredale in 1923 were published in *Proc. Roy. Zool. Soc. N.S.Wales*, 1948-49 (1950):16-20. Iredale proved to be far more than an amanuensis as he was passionately interested in nomenclature and taxonomy, in old books and the lives of early naturalists and collectors and he played an active part in writing papers for or with Mathews about avian records. For four years Iredale served on the committee on nomenclature of the British Ornithologists' Union. Someone asked how a New Zealander could know British birds so well; he did not realise that Tom's childhood had been spent amongst them in the dales and the Lake Country.

As well as birds, in 1910, Iredale studied the molluscs he called loricates, better known as chitons, and the Museum National d'Histoire Naturelle, Paris,

⁽²⁾ Iredale, *Austr. Zool.*, 4, 1927:331.

sent loricates to him in London for comparative purposes. The British Museum at Kensington being the hub of the world of natural history, Iredale came into contact with many of the leading zoologists and collectors of the day, including C. Chubb and Frederick C. Selous of South Africa, Colonel Meinertzhagen, various aristocrats and scholars, and many others, including Dr. Marie Stopes, an early champion of women's rights.

In 1913, the Hon. Nathaniel Charles Rothschild (1877-1923), an authority on Siphonaptera, employed Iredale to go to Hungary to collect fleas from birds. No passport was necessary; he simply took the boat-train from London. Iredale told amusing stories of his language difficulties. He spoke northern English himself and could understand a fair amount of German and could read French and Latin, but naturally Hungarian was foreign in every way, but he managed to shoot some birds and collect their parasites. Iredale was then briefly in Germany and Holland and spent some time in the Museum in Vienna examining Reischek's collection of New Zealand birds (see item 28 in bibliography: *Austral Avian Record*, 2(1), Aug. 1913:14-32). Iredale evidently had a very friendly regard for his employer, a colourful member of the famous clan, who used to have a carriage drawn by zebras. Tom always referred to him as "Fatty" Rothschild, yet amongst his manuscripts, Iredale had the following notes, written on mourning notepaper, evidently towards an obituary notice:

"... He and his brother brought out a Journal of their own to record all the new species of Birds, Mammals, Butterflies and Fleas. More recently Charles developed a separate publication for fleas alone.

"On his father's death it was found that the banking business had been willed to Charles, the present Lord Rothschild being left only a comparatively small annuity. Charles was a delightful personage, very level-headed, clear-thinking and systematic. When war broke out he was called into consultation with the Government on financial matters and very unexpectedly the strain caused a breakdown and he had to retire to Switzerland where he remained till lately. Apparently he never recovered fully, and now he has gone, everyone who has ever met him will be very sad as he had no enemies."

Another Rothschild (Lionel Walter, 2nd Baron Rothschild, 1868-1937) named a new snipe from New Zealand after Iredale. This Sir Lionel Walter Rothschild acquired the Mathews collection of Australian birds which is now in the American Museum of Natural History, New York.

In 1914, Iredale was pronounced unfit for military service in World War I. In this year, mollusca were sent to him from the Monte Bello Islands, north-western Australia, for report. On October 16th 1914, the great American conchologist, William H. Dall pleased Tom Iredale when he wrote to him from the Smithsonian Institution:

"Dear Mr. Iredale:

I am just back from my summering on Mt. Monadnock and looking over the Mal. Soc. numbers for the summer find your papers on nomenclature. I think some millionaire ought to endow a chair of Molluscan nomenclature with a view to getting a perfect Nomenclator, and nominate you as incumbent for life. You certainly have a genius for that line of work. For that reason it is not without a certain amount of glee that I find myself (*mirabile dictu!*) able to point out a couple of instances where the data in my Florida paper would have carried you further.

"My regards to [E.A.] Smith, Sherborn and the rest of the conchological staff.

"Always yours sincerely,

[Signed] Wm. H. Dall."

In 1915, Iredale's critical Commentary on Suter's *Manual of the New Zealand Mollusca* made him unpopular in some quarters, yet his was an objective review, written without malice to put right such maladjustments Iredale (with his extensive New Zealand and British Museum experience) considered worthy of remedy.

Next year Iredale was impressed by Professor Lancelot Harrison's work on the Mallophaga—highly modified insects parasitic on birds—which suggested interesting lines of enquiry concerning relationships and distribution of birds, particularly sea-birds⁽³⁾. (See bibliography, *infra*, item 57).

⁽³⁾ Harrison was my teacher of zoology at the University of Sydney. Biographies of him appeared in 1928 in the *Australian Zoologist*, *Australian Museum Magazine*, *Emu*, *Nature* and the *Proceedings* of the Linnean Society of New South Wales. He was unfortunately short-lived and his work on parasites seems to have been undeservedly forgotten or overlooked.—G.P.W.

Iredale was a great friend and helper of Charles Davies Sherborn who was then compiling his monumental *Index Animalium*. Sherborn was only being paid £100 a year for this exacting work. Even after Iredale arrived in Australia in 1923, Sherborn sent him a set of galley-proofs of his *Index Animalium* for his use and advice. Iredale considered that his most spectacular discovery was the mollusc he named *Sherbornia mirabilis* (see bibliography, 65:331). He first exhibited the adult shell before the Malacological Society of London, in Burlington House, Piccadilly, in 1917, where it defied recognition as a mollusc until he produced the younger stadia which showed it to be an extremely modified gastropod. A paratype of *S. mirabilis* is preserved in the Australian Museum (registered no. C.49706). Some time ago, Tom Iredale kindly gave me the letter from Sherborn in which the compliment of the generic name is acknowledged, as follows:-

16 Nov. 17

B.M. (N.H.)

"Dear Iredale

It is with peculiar satisfaction that I see your new genus *Sherbornia*. And in paying me this compliment I recognise that you are of all people the most able to judge of the value of my labours for you are the one above all that has made it his business & pleasure to work almost daily on my manuscripts & appreciate their wide range. I thank you & hope you will consider that those manuscripts are always at your service.

Believe me

sincerely yours

[Signed] C. Davies Sherborn."

In 1918, Sir Sydney Harmer invited Iredale to identify molluscs from New Zealand and Fiji. And in April 1920, Herbert E. Gregory, Director of the Bernice Pauahi Bishop Museum at Honolulu, impressed by Iredale's work on the Kermadec Islands land mollusca, offered him a position on the museum staff: "The significance of your studies", wrote Gregory, "the manner of presentation, and your obviously good field methods, leads me to wish that you might become actively engaged for a term of years in Pacific Ocean investigations." The offer, however, was not accepted.

In 1921, the first (and only) volume of *A Manual of the Birds of Australia* by Mathews and Iredale appeared. But another group of mollusca also received attention, resulting in a "List of British Nudibranchiate Mollusca" in collaboration with C. D. O'Donoghue in 1923. On June 7th of that year Iredale left London for the last time.

Arrival in Sydney

In the latter half of 1923, Tom Iredale came to Sydney for the Pan Pacific Science Congress and I remember visiting Bottle and Glass Rocks, Port Jackson, with Charles Hedley, Iredale and Henry Pilsbry to collect molluscs at that time. Pilsbry and Iredale joked about the rough train-rides they had had between Port Phillip and Port Fairy in Victoria.

H. A. Pilsbry later (July 19th 1928) wrote to Iredale from the Hotel Camaguey, Cuba:

"... Do you still ride on those market trains, such as that we took from Port Philip? I have never really liked pigs since that ride in the society of so many dead ones.

"I think it was wonderful of you and Basset Hull to dedicate your *Chiton* (excuse me! *Loricata*) book to me. Of course I think you make the genera too small, but this is a mere matter of opinion. The actual work in defining clearly the groups & species & producing a practical & readily usable handbook, this I think you have very successfully carried out. I am proud to have so good a book dedicated to me, and I thank both of you ...

"I came down here chiefly to get certain land snails I have long desired to dissect. Am having good success, but find the collecting at this season rather strenuous. The mosquitos make life a continual fight in the hills. Moreover, there is much rain, which is hard on both scientists and horses. In the parts we have been working there are practically no vehicle roads—we have to go everywhere in the saddle. But often Urocoptidae & operculates are to be gathered off the rocks by hundreds—like the marines in Port Jackson ...

Yours [Signed] H. A. Pilsbry."

Iredale greatly admired and respected both Hedley and Pilsbry. He was unemployed when he came to Sydney in 1923 and, being asked his profession for the electoral roll, replied that he wrote articles; he was consequently 'enrolled' as a journalist! Iredale worked on shells at the Australian Museum with

Hedley, assisted by Joyce Allan and with Phyllis Clarke (later Mrs. P. North) as artist. Hedley was disappointed at not having been appointed Director of the Museum and he was clearing up his papers on land shells preparatory to taking charge of his work for the Great Barrier Reef Committee. Hedley had been instrumental in getting Iredale to come out from England to work on land shells with him and on loricates (chitons) with A. F. Basset Hull.

Tom Iredale was appointed Assistant to the Shell Department when Hedley resigned and Joyce Allan was temporarily in charge⁽¹⁾, and later Conchologist. This arrangement resulted in a long series of papers illustrated by Miss Allan. In those days, John Brazier, bulky and shuffling, and Thomas Whitelegge, short and slight, used to visit the Australian Museum. Both of these famous invertebrate zoologists had been retrenched from the staff during the 1893 depression and they came in to sell Hedley a few shells for sixpence or so to help support themselves. At that time, Iredale had a huge, broad-brimmed straw hat, a corduroy coat with its "poacher's pockets" stuffed with books and papers and wore soft, noiseless shoes. He would suddenly appear at one's door, grinning and more often than not making some raucous, critical comments in his then broad Cumberland accent. To the sedate members of the staff, he seemed like one of his own stormy petrels. His cocksure, pungent remarks on whatever we were doing were somewhat disconcerting and, to make matters worse, he was almost always right. Iredale's influence caused a sort of chain reaction. He taught us not to follow the respected authorities but to investigate afresh at first hand; not to continue the old slipshod taxonomy and to copy synonymies from books, but to make our own check-lists and bibliographies and personally *check* every reference in them. He insisted on determining exact dates of publication of books and papers, similarly priorities of names, and whether or not they were preoccupied. He gave us a hint (which he sedulously adopted himself): never underline a scientific name in your manuscript until after you have checked it and its reference as being correct. Even in this minor way, we were made to turn the semi-automatic routine of italicizing into one more rigorous discipline for the sake of accuracy.

From 1923 he worked consistently on the monograph of loricates with Basset Hull. Now and then he went on a collecting trip (see list of localities, *infra*, pp. 71 & 72). In 1925, he investigated the identity of Captain Cook's Kangaroo with Ellis Troughton. From 1926 he interested himself in cuttlefish 'bones' which had been neglected by conchologists. In May-June 1926 he made a large collection of shells from Michaelmas Cay, off Cairns, Queensland with Hedley (who was in charge of reef-boring operations in continuation of his Funafuti work) and myself. On the way back, we visited Caloundra. Back at the Australian Museum at that time there was some disaffection between some of the staff and those who governed their activities. The *Daily Guardian* newspaper, Sydney, Oct. 23rd 1926, observed:-

"Bird man among shells.

"Note that the State possesses Mr. Iredale, considered to be one of the world's greatest ornithologists. Note also that his main job at the Museum is classifying the shell department; sea shells not egg shells. The snake man attends to ornithology!

"Mr. Iredale's prominence as an ornithologist is illustrated by his selection to collect and classify data and compile volumes on bird life of the Antarctic from the odd and scattered notes made on the Mawson expedition by men who were not bird men."

The Mawson expedition's birds were eventually written up by R. Falla. Some were registered at the Australian Museum in 1922.

In November 1927, with Alexander H. Chisholm, Iredale visited the Five Islands, off the New South Wales coast, his experiences having been related in "A wave-guarded kingdom of birds" (Item 150 of bibliography). Landing on and disembarking from these rugged islets with their rough seas is difficult and dangerous and Chisholm commented later on Iredale's courage, considering that he never learnt to swim. He even donned a diver's helmet and went below when he was a guest of the British Great Barrier Reef Expedition in 1928-29, when he collected at Low Isles and other places in North Queensland, including Cooktown.

⁽¹⁾ *Annual Report*, Australian Museum, 1924:2.

In the 1920s and 1930s marine borers were cause for concern as they were gravely damaging harbour structures and ships, especially around Sydney and Brisbane. Along with other scientists and engineers, Iredale investigated in the field and the museum the animals responsible and newly named certain new molluscs and a crustacean.

He joined the Royal Zoological Society of New South Wales in 1929 or earlier.

In 1931, with Melbourne Ward and myself, he lectured and collected during visits of tourists to the islands of the Capricorn Group, Queensland.

In October and November 1933, he attended the Royal Australasian Ornithologists' Union Campout at Moree, New South Wales⁽⁵⁾, travelling by road through Murrurundi, Moree, Curlewis, etc. with Cecil ("Johnno") Rhodes, a tough "character" of an ornithologist and egg-collector, whose panache and knowledge of birds Tom much admired. They did not get as far as the Macquarie Marshes but waded in the wetlands and observed many birds.

His collecting localities

The Australasian places where Tom Iredale collected specimens are arranged below in geographical sequence, with dates when known. The data are derived from personal conversations with Tom, our field diaries, the mollusca and bird registers of the Australian Museum and that museum's *Annual Reports, Magazine*, etc. His specimens are in the Canterbury Museum, Christchurch, New Zealand, the Australian Museum, Sydney, and the British Museum (Natural History), London.

KERMADEC ISLANDS, South Pacific Ocean (Jan.-Nov. 1908).

LORD HOWE ISLAND, South Pacific Ocean (Dec. 1931-Jan. 1932).

Shells in Austr. Mus. (nos. C.57571 et seq.).

NEW ZEALAND, especially around Christchurch (1902-1908).

QUEENSLAND: With the British Great Barrier Reef Expedition, mainly on Low Isles, off Port Douglas (Oct. 9th-Nov. 1928), also Three Isles (April-May 1929), Pixie Reef, Batt Reef and dredging stations listed in *Gt. Barr. Reef Exped. Rept.*, 5(6), 1939:221, and the Daintree River. Iredale also walked from Cape Bedford to Cooktown in 1929. Cairns and Kuranda (June 13th-16th 1926).

Michaelmas Cay, off Cairns (May 15th-June 13th 1926).

Lindeman Id. and Seaforth, near Mackay (Nov.-Dec. 1934).

North-west Islet, Capricorn Group (May 19th-29th 1931, and later trips).

Port Curtis (1909).

Caloundra (Feb. 1909, about 300 species of molluscs, including chitons, collected, and June 18th-21st 1926).

Moreton Bay and Stradbroke Id. (June-July 1936).

Brisbane River (1928, June 1931 and 1936, re marine borers).

Noosa River (1942 or earlier, probably with Dr. H. L. Kesteven).

Lake Cootharaba (Dec. 1938-Jan. 1939).

NEW SOUTH WALES: Moree (Oct.-Nov. 1933). Bulladelah (several visits with Dr. H. L. Kesteven).

Broken Bay (1940).

Manly and beaches to northward, Dee Why, Long Reef, etc. (1923 onwards).

Port Jackson: Bottle and Glass Rocks (1923 and 1928 onwards).

Sydney Harbour and Parramatta River (marine borers, 1928-32).

Kurnell, Botany Bay (about 1926).

Jibbon Beach, dredging (March 12, 1925 and Oct. 3, 1926).

Gunnamatta Bay (1924 onwards, 1932 etc.).

Shellharbour (1924).

Five Islands, off Wollongong (Nov. 1927).

Albury (about 1950s)

A.C.T.: Canberra (1951).

⁽⁵⁾ See *The Emu*, 33, 1934:159-173, illustr.

VICTORIA: Westernport, Port Phillip and Port Fairy (August 1923).

Iredale also presented to the Australian Museum many Lord Howe Island, Norfolk Island and Australian shells which had been collected by his friend, Roy Bell.

In this Space Age, when scientists rarely quote any papers more than a few years old in their lists of references, it is entertaining to note that Hodge-Smith and Iredale's 1924 evidence of a negative movement of the New South Wales strand-line (bibliography, item no. 115) is still apposite for citation in a recent review on Australia's potential for offshore mineral exploitation⁽⁶⁾.

Iredale was not kindly disposed towards the "New Systematics" which swamped the academic world about the 1940s under the influence of Julian Huxley and Ernst Mayr. Some of Tom's remarks on "new systematics" had more than a trace of asperity, yet when Mayr and Iredale met in Sydney, they were the best of friends, and Mayr compared their relationship with that of two dogs which bark at one another through a fence yet become fast friends when the gate is opened.

For twenty years Tom worked as Conchologist at the Australian Museum, not only producing papers on new mollusca, but biographical notes and bibliographies of naturalists, studies in ecology and zoogeography, and the linking up of fossil molluscs with their living relatives.

Altogether he named (sometimes in joint authorship) more than 2,600 new genera and species of animals.

He also lectured frequently and wrote popular scientific articles. Under various pseudonyms, these appeared in Sydney newspapers and *The Australian Cage Bird & Pigeon World*, a weekly magazine (price threepence) published between August and December 1935, in which he mostly signed himself Garrio (Latin for I chatter). It is surprising to see in this avicultural journal excellent photographs of gannets, pelicans, and albatrosses.

The Man

Tom Iredale was of medium height and build, and weighed between 70 and 80 kg. in his active years, with brown scintillating eyes, strong teeth and a prominent sloping nose; even in old age his hair retained some of its dark brown colour and was not completely grey or white. He did not smoke and was a sparing eater and drinker. He said he dreamt complete novels, plots and all. He enjoyed light reading for recreation. Some of his colleagues, regarding themselves as arbiters of taste, thought Tom was something of a Philistine for admiring Liberace's piano recitals or going to Billy Graham's crusades. He did not care much for music but enjoyed song recitals by Clara Butt and Frances Alva. He called himself an agnostic but he knew the Holy Bible thoroughly.

Iredale manifested a great interest in sport, attending football matches and handicapping for swimming races. He was knowledgeable about cricket, horse-racing, etc. and encouraged his children in athletics, his daughter, Beryl, becoming a champion swimmer.

Although a prodigious worker, he went at a steady rate and stopped when tired or if he began to make mistakes. He might look up books and compare specimens all day and then write out his findings through half the night. His ill-health in youth seemed to have inculcated resignation in him and he would patiently lay down his pen if a colleague came to talk to him (he loved talking) or an interruption occurred. He suffered much from seasickness. His house, on part of Basset Hull's old Queenscliff estate north of Manly, was named *Solander* and his dog was called *Banks*—unusual tributes to James Cook's naturalists. Iredale observed dogs and cats closely, and the habits of introduced as well as native birds. An admirer of Gilbert White of Selborne he was collating all the editions of the famous *Natural History*, a

⁽⁶⁾ Graham A. Brown, *Hydrospace*, 1(2), 1968:28-32.

task still unfinished. Tom regretted that he had not jotted down in a diary, like White, his observations over the years of the comings and goings of birds. At first he could distinguish no yearly pattern in the Australian species but later realized that there were some systematic phenological changes (though he would not have given them that name). Tom possessed a remarkably incisive analytical brain and a prodigious memory for references in literature; his memory only became weaker towards his 90th year. He could sort out very minute shells with a hand-lens up to his nineties.

At the Australian Museum he would stand (very rarely sit) all day long at a writing desk (glancing occasionally at a game of bowls in a neighbouring rink below through his crescentic glasses), and with steel-nibbed pen and penwiper at the ready would write in that round, open hand of his page after page of manuscript. Anatole France (for whose writings, incidentally, Tom had an affectionate respect) said that Stendahl, when writing, never attempted to revise and correct. Iredale was the same: he left out all the dots on the i's and the crossing of the t's and the punctuation. Then he would check his facts again and (sometimes) attend to these matters before sending the manuscript (he never employed a typewriter) to the printer. His surroundings were always cluttered with books, papers and specimens, seemingly in hopeless confusion, yet he could lay his hand on anything wanted. The holograph manuscript of his book *The Birds of Paradise* is in the Mitchell Library; of his *Great Barrier Reef Report* (including the unfinished second part) in the Australian Museum.

Well marked in Tom was the gift of what Horace Walpole called serendipity, the faculty of finding interesting or valuable things by chance or where one least expects them. He would often pull down a book from a shelf *because* it had no title on the spine. In this way he discovered such unique items as Thomas Skottowe's unpublished paintings and natural history notes made in the early days of Newcastle, New South Wales. He made some great finds of rare books (in the dusty labyrinths of the former Charing Cross Road bookshops in London) which he purchased for Gregory Mathews or for his bibliographical friends at the British Museum, Sherborn, Francis Griffin and Alexander Reynell. Iredale was consulted by the antiquarian booksellers of London and Sydney as an expert on natural history books. In Australia he found manuscripts and published accounts of naturalists of whom he had not, or scarcely, heard in England: Lhotsky, Blandowski, James Stuart, the Verreaux brothers, Legrand, Broinowski and others; and he unearthed some Audobon relics in Sydney which were sold at great prices for the Hallstrom Estate in 1972. All these formed topics for his writings.

He worked on check-lists of Australian and Papuan mammals with Ellis Troughton, on ascidians (still unpublished) with me, and helped entomologists, historians, ornithologists and many others with complex queries. His account of *The Naturalists' Library* (List, no. 311) cost him months of hard mental work.

Iredale was most generous at putting information at his colleagues' disposal and his training, exhortation and inspiration were largely responsible for Sherborn's *Index Animalium*, Mathews' *Birds of Australia*, Troughton's mammal papers, McCulloch's posthumous *Check-list of the fishes recorded from Australia*, Whittell's *Literature of Australian Birds*, Musgrave's *Bibliography of Australian Entomology*, Miller's similar work for New Zealand, and others.

Tom Iredale was a member of the British Ornithologists' Union (from 1913), the Malacological Society of London, the Zoological Society, of ornithological societies in America, Australia and England, of the Linnean Society of New South Wales (for a few years). He was awarded the Clarke Medal by the Royal Society of New South Wales in 1959. He was President of the Royal Zoological Society of New South Wales in 1937-38 and sometime councillor, secretary and editor thereof; in 1931 he achieved the Fellowship (F.R.Z.S.). He was Conchologist at the Australian Museum from 1924 to 1944 and a revered Honorary Associate to the time of his death.

Tom left behind piles of miscellaneous manuscripts, the sorting of which will entail much study. It may still be practicable to assemble some of these for publication (subject to updating and editing). He had a monograph of stromb shells well advanced, another older MS revised *Janthina* spp.; there are a check-list of the birds of India, a list of marine mollusca from the Capricorn Group, Queensland (1931), a taxonomic list of ascidians, and notes towards a second report on Great Barrier Reef mollusca, but most of the material is condensed notes on any odd bits of paper. It seems unlikely that more new names of taxa will be forthcoming from Iredale's pen, but if they do, they will have to be added to the index given here. His wife (Lilian Medland) had painted a beautiful series of plates of Kingfishers and it is hoped to publish these with a new text, but with explanations of the plates based on Tom's MSS, in the possession of his family. She also bequeathed numerous paintings of birds from life, mostly from Britain, and studies of the morphology of the birds of New Zealand and Australia.

Tom Iredale was twice married, first to a New Zealand lady and then to Miss Lilian Medland, of Finchley, England, an artist who made the delicate and beautiful paintings which adorned Charles Stonham's *Birds of the British Islands* and Mathews and Iredale's books on the birds of Australia and New Guinea. Her painting of the Bird of Providence was the basis of the Norfolk Island two-shilling stamp⁽⁷⁾ of 1961. Many of her drawings are still unpublished. A tribute to this lady was published⁽⁸⁾, with a portrait, in 1958. There are children, grandchildren and great-grandchildren in New Zealand and Australia.

Tom Iredale was a connoisseur of antiques and brought from England an ancient wooden chest, some rare pieces of old china, and other furniture.

After his retirement from the Australian Museum, he was for a while employed by Sir Edward Hallstrom for expert advice on ornithological and avicultural books. He also visited the museum two or three times a week until 1968 when age was beginning to tell on him. He knew nothing of driving a car and still walked long distances. I had the pleasure of taking Dr. Winston Ponder, the new Curator of Mollusca at the Australian Museum, to see Iredale at *Solander* just before he moved to Harbord, where other scientists used to visit him, a delightful occasion for all concerned. His eyesight and memory were excellent for his great age, but it was hardly surprising that he gently passed away at Curl Curl, New South Wales on April 12th 1972, aged 92.

The words written well over a century ago by Edward Newman concerning another great English naturalist, William Yarrell, apply with equal force to Tom Iredale:

"Often have I had occasion to appeal to him in difficulties about specific character or points of economy, and from the very moment of mentioning the doubt or the object of enquiry, his whole attention was absorbed by it; books, specimens, memory, every auxiliary was at his finger-ends; and no sacrifice of time or trouble was too great for him to make; neither was the subject ever left undecided while diligence or a disposition to teach could throw on it a single ray of light. No other subject seemed to occur to him during the investigation; he had no other occupation; that one enquiry was, for the time, the object of his life. His power of concentrating his attention on a single subject was most extraordinary, and more extraordinary still was the facility with which that concentrated attention was turned to *any* subject; he used it after the fashion of a burning glass, casting the focus wherever he pleased. This faculty was at the service of all; and the attention of which I speak thus gratefully from personal experience was given to every truth-seeking enquirer."

And it is also true of both Yarrell and Iredale to say, "... he smuggled in a certain amount of geography under the garb of ornithology⁽⁹⁾."

Many species were named after Iredale in ornithology, ichthyology and conchology, the last one known to him being a gastropod from Lord Howe Island, *Favartia (Murexiella) iredalei* Ponder⁽¹⁰⁾. New genera employing his patronymic were: *Irediparra*, *Iredaleoconcha*, *Tomirdus*, *Iredalea*, *Iredalina*, *Iredaleichthys*, *Iredaleornis* and *Iredalella*.

⁽⁷⁾ *Philatelic Bulletin* (Melbourne), 8(6), June 1961:44-45.

⁽⁸⁾ *Proc. Roy. Zool. Soc. N.S.Wales*, 1956-57 (1958):13-14.

⁽⁹⁾ Yarrell, *History of British Fishes*, ed. 3, 1859: xiii & xiv, ex Edward Newman, MS.

⁽¹⁰⁾ Ponder, *Journ. Malac. Soc. Austr.*, 2(3), 1972:232, pl. 21, fig. 3.

He was "Australia's Linnaeus" and when a *Fauna australiensis* eventually appears, the name of Tom Iredale might well head the list of those to whom such a compilation might fittingly be dedicated.

Acknowledgements

I thank Dr. Winston Ponder, Curator of Mollusca, Mr. H. J. de Disney, Curator of Birds, Dr. D. F. McMichael, Honorary Associate, and the Librarians, of the Australian Museum; also Mr. Rex Iredale, Master Ian Iredale and Mrs. R. Page for help during the preparation of this memorial notice.

A former Assistant of Tom Iredale's at the Australian Museum and now Director of the National Parks and Wildlife Service, Sydney, Dr. D. F. McMichael and I wrote a bibliography of Iredale's writings and an index to his new names. This was printed⁽¹¹⁾ in 1956 to celebrate the golden anniversary of his career as an author, but it is now out of print and so is here reprinted and brought up to date with numerous intercalated references.

To avoid altering thousands of ciphers in the List of New Names (below), the numbering of the published items follows that of McMichael & Whitley (*loc. cit.*), but intercalated papers have been lettered (*e.g.*, 7A, B, C; 19A, etc.).

Joint authors with Tom Iredale

The names of Iredale's collaborators are listed below and the papers with which they were concerned are indicated by numbers:

- Allan, Joyce, 180A, 249, 263, 314 (2 editions), 326A.
- Bannerman, D. A., 84.
- Barrett, Charles, 185.
- Boardman, W., 129, 141, 170, 179A.
- Cayley, N. W., 121.
- Cooper, Roy, 217.
- Cotton, B. C., 314 (2 editions), 326A.
- Hartert, E., 82.
- Hodge Smith, T., 115.
- Hull, A. F. Basset, 104, 109, 114, 118, 128, 131, 138, 142, 147, 148, 154, 162, 166, 180, 181.
- Johnson, R. A., 182, 208, 212, 243.
- Kinghorn, J. R., 110.
- Laseron, C. F., 330.
- Livingstone, A., 129, 141.
- McMichael, D. F., 349, 350.
- McNeill, F. A., 129, 141, 151, 182, 208, 212, 243.
- Marshall, A. J., 191.
- Mathews, G. M., 19, 24, 27, 31, 33, 42, 49, 52, 56, 66, 67, 71, 73, 74, 76, 77, 78, 79, 80, 83, 86, 89, 90, 93, 94, 97, 98, 100, 133, 199, 200, 235.
- May, W. L., 62.
- Mestayer, M. K., 6.
- O'Donoghue, C. D., 99.
- Rainbow, W. J., 7D.
- Roughley, T. C., 189.
- Slater, W. L., 82.
- Sherborn, C. D., 81.
- Smith, Gladys Charter, 198A.
- Smith, Thomas Hodge, 115.
- Tomlin, J. R. le B., 63.
- Troughton, E. le G., 117, 187, 195, 216, 352.
- Watson, C. J. J., 208.
- Whitley, G. P., 140, 152, 164, 183, 185, 198, 229, 250A, 274, 334A, 351, 353, 355, 358, 359, 360, 361 and in press.

⁽¹¹⁾ McMichael & Whitley, *Austr. Zool.*, 12(3), 1956: 211-250.

In addition, some papers were written as a member of the British Ornithologists' Union Committee on the nomenclature of birds.

CHRONOLOGICAL LIST OF WRITINGS

1907

1. On the Occurrence in New Zealand of *Platalea regia*, Gould.
Trans. New Zealand Inst., 39: 137, June, 1907.

1908

2. *Synoecus australis* in New Zealand.
Emu, 7: 165, January, 1908.
3. Notes on some New Zealand Marine Molluscs.
Trans. New Zealand Inst., 40: 373-378, pl. 31, "June" (=October), 1908.
4. A Preliminary List of the Marine Mollusca of Banks Peninsula, New Zealand.
Trans. New Zealand Inst., 40: 387-403, "June" (=October), 1908.
5. List of Marine Molluscs collected in Otago.
Trans. New Zealand Inst., 40: 404-410, "June" (=October), 1908.
6. List of Marine Mollusca from Lyall Bay, near Wellington, New Zealand. (By T. I. and M. K. Mestayer).
Trans. New Zealand Inst., 40: 410-415, "June" (=October), 1908.
7. Additional List of Mollusca: Minute species found in Sand at Titahi Bay, New Zealand.
Trans. New Zealand Inst., 40: 559, "June" (=October), 1908.
- 7A. The Kermadec Islands Expedition. The story of its work. No. I. *The Press* [Christchurch, New Zealand], p., 1908.
The Weekly Press [Christchurch, New Zealand] 49 (2284): 42 [5 photos. by T. Iredale], 83 & 84, Dec. 23 [or earlier⁽¹²⁾], 1908.
- 7B. Kermadec Islands Expedition. II. The Zoology of the Islands. *The Press*, Monday, Dec. 7, 1908, page 8 and *The Weekly Press* 49 (2285): 47 [3 photos. by T. Iredale], 82 & 83, December 7 & 30, 1908.

1909

- 7C. Kermadec Islands Expedition. III.
Weekly Press [Christchurch], Jan. 6, 1909: 83 and illustration on p. 40. Published simultaneously in *Supplement to the Auckland Weekly News*, Jan. 6, 1909: 83, 6 figs., including portrait of T. Iredale. Jan. 6, 1908.
- 7D. The Kermadec Islands.
Australian Naturalist 1 (13): 153-155 [By W. J. Rainbow, ex T. Iredale's MS.], Jan. 1909.
- 7E. A storm-swept coastline: a typical scene on the harbourless Kermadec Islands, which lie to the north of New Zealand.
Auckland Weekly News, Feb. 11, 1909, supplement, page 1, photo., Feb. 11, 1909.

1910

8. Bird Life on the Kermadec Islands.
Emu, 10: 2-16, pls. 2-5, January, 1910.
9. On Marine Mollusca from the Kermadec Islands, and on the "*Sinusigera Apex*".
Proc. Mal. Soc. London, 9: 68-79, March 31, 1910.
10. Notes on Polyplacophora, chiefly Australasian. (Part 1).
Proc. Mal. Soc. London, 9: 90-105, June 30, 1910.
11. Some Notes on Pyramidellid Nomenclature.
Nautilus, 24: 52-58, September, 1910.

⁽¹²⁾ Probably published earlier in *The Press* and reprinted in *The Weekly Press* [Christchurch, Auckland?], otherwise Part II would have been issued before Part I.

12. Notes on Polyplacophora, chiefly Australasian. (Part 2).
Proc. Mal. Soc. London, 9: 153-162 September 26, 1910.
- 1911
13. On Marine Mollusca from the Kermadec Islands and on the "*Sinusigera* Apex".
Proc. New Zealand Inst. for 1910, pt. 2: 57-58, January 18, 1911.
(Abstract and list of names from (9) above).
14. A new generic name for the Australian Crane.
Bull. British Orn. Club, 27: 47, January 23, 1911.
15. An additional Note on the Birds of Lord Howe and Norfolk Islands.
Proc. Linn. Soc. New South Wales, 25: 773-782, March, 1911.
16. On some misapplied Molluscan Generic Names.
Proc. Mal. Soc. London, 9: 253-263, March 30, 1911.
17. Description of *Cinclohamphus rufescens mathewsi*.
Bull. British Orn. Club, 27: 97-98, May 26, 1911.
18. On the value of the Gastropod Apex in Classification.
Proc. Mal. Soc. London, 9: 319-323, June 30, 1911.
- 1912
19. "Perry's Arcana"—an overlooked work. (G. M. Mathews and T. I.)
Victorian Naturalist, 29: 7-16, May 9, 1912.
- 19A. *Chaetopleura brucei*, Iredale, sp.n.
In J. C. Melville & R. Standen, "The Marine Mollusca of the Scottish National Antarctic Expedition." *Trans. Roy. Soc. Edinburgh* 48, 1912: 343 = Scottish National Antarctic Expedition *Rept. Sci. Res. Voy. S.Y. "Scotia"*, vol. vi, Zool., Edinb. Scottish Oceanogr. Lab. 1912: 117, plate, figs. 24, 24a-d, August 26, 1912.
20. New Generic Names and new species of Marine Mollusca.
Proc. Mal. Soc. London, 10: 217-228, pl. 9, 3 text figs., October 30, 1912.
- 20A. Note [on the generic names *Antigone* and *Mathewsia*].
Austral Avian Rec. 1(5): 123, December 24, 1912.
- 1913
21. Solander as an Ornithologist.
Ibis, 1913: 127-135, January, 1913.
22. On the type specimen of *Larus affinis* Reinhardt.
Bull. British Orn. Club, 31: 68-69, January, 1913.
23. A Collation of the Molluscan Parts of the Synopses of the Contents of the British Museum, 1835-1845.
Proc. Mal. Soc. London, 10: 294-309, March 28, 1913.
24. A Reference List of the Birds of New Zealand. Part 1. (G. M. Mathews and T. I.).
Ibis, 1913: 201-263, April 2, 1913. (Issued as Separate with Part 2, No. 27 below).
25. The Lesser Blackbacked Gull of the British Islands.
British Birds, 6: 360-364, pl., May 1, 1913.
26. Concerning the Kermadec Islands Avifauna.
Trans. New Zealand Inst., 45: 78-92 June 9, 1913.
27. A Reference List of the Birds of New Zealand. Part 2. G. M. Mathews and T. I.).
Ibis, 1913: 402-452, July 1, 1913.
28. On some interesting birds in the Vienna Museum.
Austral Avian Rec., 2: 14-32, August 2, 1913.
29. The generic name to be used for *Murex tritonis* Linne.
Nautilus, 27: 55-56, September, 1913.
30. The Land Mollusca of the Kermadec Islands.
Proc. Mal. Soc. London, 10: 364-388, pl. 18, September 22, 1913.
31. Notes on Billberg's Synopsis Faunae Scandinaviae. (G. M. Mathews and T.I.).
Austral Avian Rec., 2: 33-48, October 23, 1913.

1914

32. The Chiton Fauna of the Kermadec Islands.
Proc. Mal. Soc. London, 11: 25-51, pls. 1 & 2, March 30, 1914.
33. Description of a strange New Zealand Wood-Hen. (G. M. Mathews and T.I.).
Ibis, 1914: 293-297, pl. 11, April 2, 1914.
34. The genus-name *Martensia*, Sempér.
Proc. Mal. Soc. London, 11: 120-122, June 24, 1914.
35. Some more notes on Polyplacophora. Part 1.
Proc. Mal. Soc. London, 11: 123-131, June 24, 1914.
36. The Surface Breeding Petrels of the Kermadec Group.
Ibis, 1914: 423-436, pl. 15, July 3, 1914.
37. On *Sterna fuscata* Linne.
Ibis, 1914: 436-437, pl. 16, July 3, 1914.
38. Report on Mollusca collected at the Monte Bello Islands.
Proc. Zoo. Soc. London, 1914: 665-675, 3 text figs., September, 1914.
39. On Some Invalid Molluscan Generic Names.
Proc. Mal. Soc. London, 11: 170-178, September 5, 1914.
40. Description of a new species of *Cassidea*.
Proc. Mal. Soc. London, 11: 179-180, text fig., September 5, 1914.
41. On the Genus-name *Mathewsia*.
Austral Avian Rec., 2: 81-82, September 24, 1914.
42. Notes on some Birds from the Kermadec Islands. (G. M. Mathews and T.I.).
Austral Avian Rec., 2: 113-114, September 24, 1914.
43. On *Herodias eulophotes* Swinhoe.
Ibis, 1914: 541-545, pl. 20, October 1, 1914.

1915

44. Review: "Manual of the New Zealand Mollusca".
Journ. of Conchol., 14: 287-288, January 1, 1915.
45. The relation of colour-pattern to the question of "genera-splitting" or "genera-lumping".
Bull. British Orn. Club, 35: (68), 82-83, February 27, 1915.
46. The New B.O.U. List; more corrections.
Ibis, 1915: 388-390, April 8, 1915.
47. Some more misused Molluscan Generic Names.
Proc. Mal. Soc. London, 11: 291-306, June 17, 1915.
48. On Humphrey's Conchology.
Proc. Mal. Soc. London, 11: 307-309, June 17, 1915.
49. On the Ornithology of the Dictionnaire des Sciences Naturelles (Levrault). (G. M. Mathews and T.I.).
Austral Avian Rec., 3: 5-20, June 30, 1915.
50. British Bird Names.
British Birds, 9: 53-54, July 1, 1915.
51. The Nomenclature of British Marine Mollusca.
Journ. of Conchol., 14: 341-346, July 1, 1915.
52. On Some Petrels from the North-East Pacific Ocean. (G. M. Mathews and T.I.).
Ibis, 1915: 572-609, text figs, July 2, 1915.
53. A Commentary on Suter's "Manual of the New Zealand Mollusca".
Trans New Zealand Inst., 47: 417-497, July 12, 1915.
54. A Comparison of the Land Molluscan Faunas of the Kermadec Group and Norfolk Island.
Trans. New Zealand Inst., 47: 498-508, July 12, 1915.
55. Notes on the Names of Some British Marine Mollusca.
Proc. Mal. Soc. London, 11: 329-342, August 20, 1915.
56. On the "Table des Planches Enlum." of Boddaert. (G. M. Mathews and T.I.).
Austral Avian Rec., 3: 31-51, November 19, 1915.

1916

57. Discussion of "Bird Parasites and Bird Phylogeny".
Bull. British Orn. Club, 36: 53-54, February 3, 1916.
58. On Some New and Old Molluscan Generic Names.
Proc. Mal. Soc. London, 12: 27-37, March 20, 1916.
59. Questions de Nomenclature.
Revue Critique de Paleozoologie, 20th year, No. 3: 128-131, July, 1916.
60. On Two Editions of Dumeril's Zoologie Analytique.
Proc. Mal. Soc. London, 12: 79-84, November 28, 1916.
61. Solander as a Conchologist.
Proc. Mal. Soc. London, 12: 85-93, November 28, 1916.
62. Misnamed Tasmanian Chitons. (T. I. and W. L. May).
Proc. Mal. Soc. London, 12: 94-117, pls. 4 & 5, November 28, 1916.

1917

63. *Lienardia mighelsi* nom. nov. (T.I. and J. R. le B. Tomlin).
Journ. of Conchol., 15: 216, August 15, 1917.
64. More Molluscan Name-Changes, Generic and Specific.
Proc. Mal. Soc. London, 12: 322-330, November 10, 1917.
65. On some new species of Marine Mollusca from Christmas Island, Indian Ocean.
Proc. Mal. Soc. London, 12: 331-334, pl. 13, November 10, 1917.
66. Avian Nomenclatorial Notes. (G. M. Mathews and T.I.).
Austral Avian Rec., 3: 113-126, December 28, 1917.

1918

67. A Forgotten Ornithologist. (G. M. Mathews and T.I.).
Austral Avian Rec., 3: 142-150, June 25, 1918.
68. The Validity of Some Generic Terms. (G. M. Mathews and T.I.).
Austral Avian Rec., 3: 151-158, June 25, 1918.
69. Review: "Loomis on the Petrels etc."
Ibis, 1918: 502-505, July 15, 1918.
70. Molluscan Nomenclatural Problems and Solutions—No. 1.
Proc. Mal. Soc. London, 13: 28-40, September 9, 1918.

1919

71. Proper Name of the Tree Sparrow. (G. M. Mathews and T.I.).
Auk, 36: 114, January 5, 1919.

1920

72. Avian Taxonomy. (G. M. Mathews and T.I.).
Austral Avian Rec., 4: 29-48, July 28, 1920.
73. A Name-List of the Birds of New Zealand. (G. M. Mathews and T.I.).
Austral Avian Rec., 4: 49-64, July 28, 1920.
74. A Name-List of the Birds of Australia. (G. M. Mathews and T.I.).
Austral Avian Rec., 4: 65-72, July 28, 1920. (See No. 76 below).
75. Preliminary Notice of Roy Bell's Molluscan Collections.
Proc. Mal. Soc. London, 14: 48, September 20, 1920.
76. A Name-List of the Birds of Australia (Concluded). (G. M. Mathews and T.I.).
Austral Avian Rec., 4: 73-113, December 16, 1920.
77. Forgotten Bird-Artists and an Old-Time Ornithologist. (G. M. Mathews and T.I.).
Austral Avian Rec., 4: 114-122, December 16, 1920.
78. Snipe and Sandpipers: A Rearrangement. (G. M. Mathews and T.I.).
Austral Avian Rec., 4: 123-129, December 16, 1920.
79. Sherborn and the Systematist. (G. M. Mathews and T.I.).
Austral Avian Rec., 4: 130-132, December 16, 1920. Continued in
Austral Avian Rec., 4: 133-134, August 1, 1921.

1921

80. A Manual of the Birds of Australia. (G. M. Mathews and T.I.).
4to. Witherby & Co., London, Vol. 1, pp. I-XXIV, 1-279, col. pls.
1-10, b. & w. pls. 1-36, March 9, 1921.
81. J. F. Miller's Icones. (C. D. Sherborn and T.I.).
Ibis, 1921: 302-309, April 4, 1921.
82. Report of the B.O.U. Sub-committee. (E. Hartert, T.I. and W. L. Sclater).
Ibis, 1921: 310-316, April 4, 1921.
83. The Nature of the New Zealand Avifauna. (G. M. Mathews and T.I.).
Emu, 20: 210-221, April 23, 1921.
84. Note with regard to the generic names *Textor* and *Hyphantornis*. (T.I. and D. A. Bannerman).
Bull. British Orn. Club, 41: 128-129, May 26, 1921.
85. Unpublished Plates of Thomas Martyn, Conchologist.
Proc. Mal. Soc. London, 14: 131-134, June 23, 1921.
86. Notes of Interest. (G. M. Mathews and T.I.).
Austral Avian Rec., 4: 139-164, August 1, 1921 (see 79 above).
87. Molluscan Nomenclatural Problems and Solutions No. 2.
Proc. Mal. Soc. London, 14: 198-208, October 24, 1921.
88. Description of *Phalaropus fulicarius jourdaini*.
Bull. British Orn. Club, 42: 8, October 29, 1921.

1922

89. An Extraordinary Bird Book. (G. M. Mathews and T.I.).
Austral Avian Rec., 4: 172-175, March 7, 1922. [Jennings's *Ornithologia*, 1828, 1829].
90. Captain Thomas Brown, Ornithologist. (G. M. Mathews and T.I.).
Austral Avian Rec., 4: 176-194, March 7, 1922.
91. A reply on the genera *Neptunea* and *Syncera*.
Proc. Mal. Soc. London, 15: 37, April, 1922.
92. The nomination of "Recent" Fossil Mollusca.
Proc. Mal. Soc. London, 15: 37-38, April, 1922.
93. Jarocki Again. (G. M. Mathews and T.I.).
Austral Avian Rec., 5: 20-21, July 17, 1922.
94. Thomas Watling, Artist. (G. M. Mathews and T.I.).
Austral Avian Rec., 5: 22-32, col. pls. 1-7, July 17, 1922.
95. *Mathewsiella*, a new generic name.
Bull. British Orn. Club, 43: 39, November 29, 1922.
96. Book Notes.
Proc. Mal. Soc. London, 15: 78-92, December, 1922.

1923

97. More Notes of Interest. (G. M. Mathews and T.I.).
Austral Avian Rec., 5: 45-73, February 21, 1923.
98. On Type Designation of Avian Genera. (G. M. Mathews and T.I.).
Austral Avian Rec., 5: 74-80, February 21, 1923.
99. List of British Nudibranchiate Mollusca. (T.I. and C. D. O'Donoghue).
Proc. Mal. Soc. London, 15: 195-233, March, 1923. In two parts, pp. 195-200, March 1923 and 201-233, June 1923.
100. The Name of the British Song-Thrush. (G. M. Mathews and T.I.).
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101. Report of the (B.O.U.) Committee on . . . Nomenclature . . . of Birds. (T.I. and others).
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102. Australian Petrel Forms: Still More to Learn.
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103. The Snowy Albatross in Sydney Harbour.
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104. A Monograph of the Australian Loricates. Part 1. (T.I. and A. F. Basset Hull).
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105. Fourth Report of the (B.O.U.) Committee on . . . Nomenclature . . . (T.I. and others).
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106. Living on a Volcano.
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107. Book Review: "Linnaeus".
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108. Lhotsky's Lament.
Australian Zoologist, 3: 223-226, May 9, 1924.
109. A Monograph of the Australian Loricates. Part 2. (T.I. and A. F. Basset Hull).
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110. The Rediscovery of the Whitebacked Wren, *Malurus leuconotus* Gould. (J. R. Kinghorn and T.I.).
Emu, 24: 59-60, July 4, 1924.
111. Museums of the Past.
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112. As Extinct as the Dodo.
Australian Museum Mag., 2: 117-120, 4 text figs., October, 1924.
113. Fairy Wrens.
Australian Zoologist, 3: 264-268, text figs., October 7, 1924.
114. A Monograph of the Australian Loricates. Part 3. (T.I. and A. F. Basset Hull).
Australian Zoologist, 3: 277-297, pls. 35-37, text figs., October 7, 1924.
115. Evidence of a Negative Movement of the Strand Line of 400 Feet in New South Wales. (T. Hodge Smith and T.I.).
Journ. Roy. Soc. New South Wales, 58: 157-168, pl. 7, 2 text figs., October 20, 1924.
116. Results from Roy Bell's Molluscan Collections.
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117. Captain Cook's Kangaroo. (T.I. and E. le G. Troughton).
Australian Zoologist, 3: 311-316, pl. 41, January 14, 1925.
118. A Monograph of the Australian Loricates. Part 4. (T.I. and A. F. Basset Hull).
Australian Zoologist, 3: 339-362, pls. 39 & 40, January 14, 1925.
119. Mollusca from the Continental Shelf of Eastern Australia.
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120. Cook's Artists.
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121. Australian Crested Penguins. (T.I. and N. W. Cayley).
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122. Captain Cook's Artists.
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123. The Scientific Name of our Club's Badge.
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124. The Status of *Amicula*.
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125. W. H. Hargraves. (Obituary Notice).
Nautilus, 39: 68-69, October, 1925.

126. R. Murdoch. (Obituary Notice).
Nautilus, 39: 69-70, October, 1925.
127. George Forster's Paintings.
Australian Zoologist, 4: 48-53, pls. 6-8, text figs., November 10, 1925.
128. A Monograph of the Australian Loricates. Part 5. (T.I. and A. F. Basset Hull).
Australian Zoologist, 4: 75-111, pls. 9-12, 3 text figs., November 10, 1925.
129. Life of the Tidal Flats. (T.I. and others).
Australian Museum Mag., 2: 285-290, 7 text figs., October-December, 1925. (Reprinted in *Sydney Harbour Trust Officers' Journ.*, 5, No. 5, 2-10, October, 1929).

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130. J. Douglas Ogilby.
Auk, 1926: 138, January, 1926. (Reprinted in Biographies of Members of the American Ornithologists' Union (Washington, D.C.), p. 432, 1954).
131. A Monograph of the Australian Loricates. Part 6. (T.I. and A. F. Basset Hull).
Australian Zoologist, 4: 164-185, pls. 18-20, 4 text figs., February 22, 1926.
132. The Cuttle-Fish 'Bones' of the Sydney Beaches.
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133. Descriptions of New Genera of Birds. (T.I. and G. M. Mathews).
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134. Three Victorian Species of *Ophicardelus* (Class Mollusca).
Victorian Naturalist, 42: 268-270, 3 text figs., March, 1926.
135. The Last Word on *Ancylastrum*.
Nautilus, 39: 114-115, April, 1926.
136. W. Lewis May. (Obituary Notice).
Nautilus, 39: 140-141, April, 1926.
- 136A. In the Museum. Snails and diseases.
Evening News (newspaper, Sydney), April 24, 1926.
137. The Biology of North-west Islet, Capricorn Group (D.) Marine Molluscs.
Australian Zoologist, 4: 237-240, pl. 35, April 28, 1926.
138. A Monograph of the Australian Loricates. Part 7. (By T.I. & A. F. Basset Hull).
Australian Zoologist, 4: 256-276, pls. 37-39, April 28, 1926.
- 138A. War on Birds. Ravages among eggs at Oyster Cay. Rapidly diminishing colony.
Cairns Post (newspaper, Cairns, Queensland), June 15, 1926.
- 138B. Naturalists who sailed with Captain Cook.
Brisbane Daily Mail and Telegraph (newspapers Brisbane), June 22, 1926. [Brisbane *Courier* about July 1926].
Queensland Naturalist (Brisbane), 5: 83-84, August 1926.
- 138C. A naturalist's life, on a coral bank.
Daily Mail (Brisbane), June 22, 1926.
139. The Cameo Shell.
Australian Museum Mag., 2: 415-417, pl., 2 text figs., October, 1926.
140. The Birth of an Island. (T.I. and G. P. Whitley).
Australian Museum Mag., 2: 418-421, 5 text figs., October, 1926.
141. More Life of the Tidal Flats. (T.I. and others).
Australian Museum Mag., 2: 429-434, 8 text figs., October, 1926.
142. A Monograph of the Australian Loricates. Part 8. (T.I. and A. F. Basset Hull).
Australian Zoologist, 4: 324-328, pl. 45, November 30, 1926.

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143. A Review of Australian Helmet Shells. (Family Cassididae—Phylum Mollusca).
Rec. Australian Museum, 15: 321-353, pls. 31 & 32, April 16, 1927.
144. The Snowy Albatross Again.
Emu, 26: 282-285, pls. 41 & 42, April 30, 1927.
145. The "Resurrected" Snail.
Australian Museum Mag., 3: 71-72, 1 text fig., April, 1927.
146. Caloundra Shells.
Australian Zoologist, 4: 331-336, pl. 46, May 18, 1927.
147. A Monograph of the Australian Loricates. Part 9. (T.I. and A. F. Basset Hull).
Australian Zoologist, 4: 339-359, pls. 47-49, May 18, 1927.
148. A Monograph of the Australian Loricates. (T.I. and A. F. Basset Hull). 4to., Roy. Zool. Soc. New South Wales, pp. I-XIII, 1-168, Frontispiece, pls. 1-21, 12 text figs., July 20, 1927.
149. New Molluscs from Vanikoro.
Rec. Australian Museum, 16: 73-78, pl. 5, October 7, 1927.

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150. A Waveguarded Kingdom of Birds.
Emu, 27: 271-274, pls. 41 & 42, April 3, 1928.
151. War Against Pests. (T.I. and F. A. McNeill).
Australian Museum Mag., 3: 197-200, 6 text figs., April-June, 1928.
152. Feathers and Fins. (The Birds and Fishes of Michaelmas Cay, Great Barrier Reef, Queensland). (T.I. and G. P. Whitley).
Australian Museum Mag., 3: 248-252, 4 text figs., July 13, 1928.
153. Review: "Contribution a l'etude des Nudibranches Neo Caledoniens, by Jean Risbec, Docteur es sciences . . ."
Australian Zoologist, 5: 261, August 17, 1928.

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154. The Loricates of the Neozelanic Region. (T.I. and A. F. Basset Hull). (See Nos. 162, 166, 180 & 181 below).
Australian Zoologist, 5: 305-323, pl. 34, 4 text figs., "March 24" (=March 23), 1929.
155. Strange Molluscs in Sydney Harbour.
Australian Zoologist, 5: 337-352, pls. 37 & 38, "March 24" (=March 23), 1929. (Introductory remarks and plates reprinted in *Sydney Harbour Trust Officers' Journal*, 5, No. 2: 20-24, pls. A & B, July 1929).
156. The Bird of Providence.
Australian Zoologist, 5: 358-361, pls. 39 & 40, "March 24" (=March 23), 1929.
157. The Vicissitudes of a Noddy; a Christmas Story.
Emu, 28: 290-291, April 2, 1929.
158. The Avifaunal Districts of Australia. (Abstract).
Rept. Austr. Assoc. Adv. Sci. (Hobart, 1928), 19: 244-245 & 249, May, 1929.
159. Naturalists in Australia—the Frenchmen.
Australian Museum Mag., 3: 357-360, 5 text figs., April-June, 1929.
- 159A. On the Great Barrier Reef Again. Some impressions.
Cairns Post (newspaper, Cairns, Queensland), June 1, 1929.
- 159B. Captain Cook's Kangaroo. A local mystery.
Cairns Post [June? or July 1929].
160. Queensland Molluscan Notes, No. 1.
Mem. Queensland Museum, 9: 261-297, pls. 30 & 31, June 29, 1929.
161. The Bird Man.
Australian Museum Mag., 3: 375-378, 3 text figs., July 18, 1929. (Reprinted with altered figures in *Gould League Songs and Poems*. Publ. by New South Wales Gould League of Bird Lovers, Sydney, pp. 8-11, 2 figs., August-September, 1934).

162. The Loricates of the Neozelanic Region. (T.I. and A. F. Basset Hull).
(See Nos. 154 above & 166, 180 & 181 below).
Australian Zoologist, 6: 75-95, pls. 9 & 10, August 13, 1929.
163. Mollusca from the Continental Shelf of Eastern Australia. No. 2.
Rec. Australian Museum, 17: 157-189, pls. 38-41, September 4, 1929.
164. Captain Cook's Leatherjacket. (T.I. and G. P. Whitley).
Australian Museum Mag., 3: 421-425, 4 text figs., October 24, 1929.

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165. Avian Sea-Toll.
Australian Zoologist, 6: 112-116, pl. 13, January 14, 1930.
166. The Loricates of the Neozelanic Region. (T.I. and A. F. Basset Hull).
(See Nos. 154 & 162 above, & 180 & 181 below).
Australian Zoologist, 6: 157-168, pl. 16, January 14, 1930.
167. Some Notable Name-changes.
Australian Zoologist, 6: 175, January 14, 1930.
168. The Passing of Campbell and Leach. (Obituary Notices).
Australian Zoologist, 6: 176-177, January 14, 1930.
169. More Notes on the Marine Mollusca of New South Wales.
Rec. Australian Museum, 17: 384-407, pls. 62-65, June 27, 1930.
170. Marine Zoological Section Annual Report. (T.I. and W. Boardman).
Australian Zoologist, 6: 186-187, August 20, 1930.
171. Queensland Molluscan Notes, No. 2.
Mem. Queensland Museum, 10: 73-88, pl. 9, August 28, 1930.
172. The Waterhouse Collections—Shells.
Australian Museum Mag., 4: 113-114, Oct. 16, 1930.
173. John Brazier, Conchologist.
Australian Museum Mag., 4: 142-143, portrait, October 16, 1930.
174. Notes on Some Desert Snails.
Victorian Naturalist, 47: 118-120, text fig., November 5, 1930.

1931

175. John Brazier 1842-1930. (Obituary Notice).
Nautilus, 44: 95-96, January, 1931.
176. Obituary Notice: John Brazier.
Journ. of Conchol., 19: 110, March, 1931.
177. Book Review: "British Antarctic ("Terra Nova") Expedition 1910 . . . Birds."
Emu, 30: 313, April, 1931.
178. Sea Kings of the Air.
Nature Magazine (Washington, D.C.), 17: 390-393, 6 text figs., June, 1931.
179. Australian Molluscan Notes. No. 1.
Rec. Australian Museum, 18: 201-235, pls. 22-25, June 29, 1931.
(Reprinted in parts with altered titles and introductory text only in *Sydney Harbour Trust Officers' Journal*, 7, No. 3: 24-25, August, 1931. *Ibid*, 7, No. 4: 10-11, September, 1931; *Ibid*, 7, No. 5: 8-9, October, 1931; *Ibid*, 7, No. 6: 24-25, November 1931).
- 179A. Marine Zoological Section (By T.I. and W. Boardman).
Austr. Zool., 7:8, Aug. 24, 1931.
180. The Loricates of the Neozelanic Region. (T.I. and A. F. Basset Hull).
(See Nos. 154, 162 & 166 above and 181 below).
Australian Zoologist, 7: 59-76, pl. 3, text figs. 1 & 2, August 24, 1931.
- 180A. Mollusca [Title of MS only, never published] (By T.I. and Joyce Allan, for Handbook of the marine flora and fauna of the Sydney District, a work never completed).
Austr. Mus. Ann. Rept., 1930-31: 10, 1931.
- 180B. [North-West Islet, Queensland].
[Galley-proofs seen of an article for the *Gladstone Observer*, Queensland newspaper of May or June 1931].

1932

181. The Loricates of the Neozelanic Region. (T.I. and A. F. Basset Hull). (See Nos. 154, 162, 166 & 180 above.)
Australian Zoologist, 7: 119-164, pls. 7-10, text figs., February 5, 1932.
182. Destruction of Timber by Marine Organisms in the Port of Sydney. (T.I. and R. A. Johnson and F. A. McNeill).
8vo, Publ. by the Sydney Harbour Trust, Sydney, pp. 1-148, pls 1-4, 24 text figs., 1 map, 45 graphs, "May" (=June 17), 1932.
(Included in the above: Cobra or Shipworms. A Systematic Account of the Teredinid Molluscs of Port Jackson (by T.I. alone.) pp. 24-40, pls. 1-4, 5 text figs.).
183. Blandowski. (T.I. and G. P. Whitley).
Victorian Naturalist, 49: 90-96, August 8, 1932.
184. Ornithological Section Annual Report.
Australian Zoologist, 7: 170-172, September 15, 1932.

1933

185. Water Life. (Charles Barrett, assisted by G. P. Whitley and T.I.)
Sun Nature Book, 4 (Sun News-Pictorial, Melbourne), 44 pp., illustr., February 6, 1933. Condensed as "Australia's Water Life" in *The Australian Do-You-Know Book* (Lever Bros., Sydney): 27-38, illustrated, 1935.
186. Branches Reports. New South Wales.
Emu, 32: 276-278, April 1, 1933.
187. The Correct Generic Names for the Grampus or Killer Whale, and the so-called Grampus or Risso's Dolphin. (T.I. and E. le G. Troughton).
Rec. Australian Museum, 19: 28-36, pl. 10, August 2, 1933.
188. Systematic Notes on Australian Land Shells.
Rec. Australian Museum, 19: 37-59, August 2, 1933.
189. The Scientific Name of the Commercial Oyster of New South Wales. (T.I. and T. C. Roughley).
Proc. Linn. Soc. New South Wales, 58: 278, September 15, 1933.
190. William David Kerr MacGillivray.
The Medical Journ. Australia, 20th Year, 2: 496-497, portrait, October 7, 1933.
- 190A. Nature's Wonderland.
Sydney Morning Herald, 1933 to 1939, a series of short, popular articles on zoological subjects by "Platypus", a pseudonym for Tom Iredale.

1934

191. Questions of Vernacular Nomenclature. Some suggestions. (T.I. and A. J. Marshall).
Emu, 33: 189-190, January, 1934. (Title and discussion).
192. Two New Generic Names for South Australian Marine Mollusca.
South Australian Naturalist, 15: 57-58, March 27, 1934.
193. Thomas Skottowe—Naturalist.
Emu, 33: 273-278, pls. 48-50, April 2, 1934.
194. Abnormal Loricates: The Earliest American Record.
Nautilus, 47: 136, April, 1934.
195. A Check-list of the Mammals Recorded from Australia. (T.I. and E. le G. Troughton).
Australian Museum Mem., 6: i-xi and 1-122, May 4, 1934.
196. The Fresh-water Mussels of Australia.
Australian Zoologist, 8: 57-78, pls. 3-6, May 9, 1934.
197. Book Review: "Traveling with the Birds."
Australian Museum Mag., 5: 216, "April 16" (=May 17), 1934.
198. The Early History of the Koala. (T.I. and G. P. Whitley).
Victorian Naturalist, 51: 62-72, 4 text figs., July 6, 1934.

- 198A. Marine Zoological Section. Annual Report. (T.I. and Gladys Charter Smith).

Proc. Roy. Zool. Soc. N.S.Wales 1933-34: 17, 1934.

- 198B. The Bird Man.

Gould League Songs and Poems (N.S.W. Gould League of Bird Lovers, Sydney): 8-11, 2 figs., Aug.-Sept. 1934. Reprinted from *Austr. Mus. Mag.* 3, 1929: 375, with another figure (cf. no. 161 of bibliography).

1935

199. Notes on Penguins. (G. M. Mathews and T.I.)
Bull. British Orn. Club, 55: 101, January 28, 1935.
200. A New Subspecies of Maccaroni Penguin. (G. M. Mathews and T.I.)
Bull. British Orn. Club, 55: 102, January 28, 1935.
201. Australian Cowries.
Australian Zoologist, 8: 96-135, pls. 8 & 9, "June 2" (=July 10), 1935. (See No. 250 below).
- 201A. Flying Wonders.
Australian Cage Bird & Pigeon World, 1(2): 20 & 29, 2 figs., August 30, 1935. [Albatrosses, by "X.L.", a pseudonym of Tom Iredale].
- 201B. What's in a name? II
Australian Cage Bird & Pigeon World, 1(3): 44, September 14, 1935. By "Garrio", a pseudonym of Tom Iredale.
- 201C. What's in a name? II
Australian Cage Bird & Pigeon World, 1(4): 57, September 27, 1935. By "Garrio".
- 201D. What's in a name? III
Australian Cage Bird & Pigeon World, 1(4): 57, September 27, 1935. By "Garrio".
- 201E. The Mistletoe Bird.
Australian Cage Bird & Pigeon World, 1(4): 58, September 27, 1935. By "K.W." [pseudonym of Tom Iredale].
- 201F. Thickheads.
Australian Cage Bird & Pigeon World, 1(5): 73, October 4, 1935. By "L.S." [pseudonym of Tom Iredale].
- 201G. What's in a name? IV
Australian Cage Bird & Pigeon World, 1(7): 106, October 25, 1935. By "Garrio".
- 201H. What's in a name? V
Australian Cage Bird & Pigeon World, 1(7): 106, October 25, 1935. By "Garrio".
202. Fatal Case of Attack by Cone.
Nautilus, 49:41, October 1935.
- 202A. Fairy Wrens.
Australian Cage Bird & Pigeon World, 1(8): 121, fig. November 1, 1935. By "A.D." [pseudonym of Tom Iredale].
- 202B. What's in a name? VI
Australian Cage Bird & Pigeon World, 1(8): 123, November 1, 1935. By "Garrio".
203. The name of the British Redshank.
Bull. British Orn. Club, 56:5, November 4, 1935.
- 203A. All about Cuckoos.
Australian Cage Bird & Pigeon World, 1(9): 139, November 8, 1935. By "K.S." [? pseudonym of Iredale].
204. Fatal Cone Bite.
Venus, 5:294, December, 1935 (In Japanese).
205. Fatal "Sting" by a Cone.
Journ. of Conchol., 20:166, December 4, 1935.
206. Fatality from Cone-bite.
Journ. de Conchyl., 79: 264-265, December 15, 1935.

1936

207. Australian Molluscan Notes: No. 2.
Rec. Australian Museum, 19: 267-340, pls. 20-24, April 7, 1936.
208. Destruction of Timber by Marine Organisms in the Port of Brisbane.
(C. J. J. Watson, F. A. McNeill, R. A. Johnson and T.I.)
Queensland Forest Service Bull. 12, pp. i-x, 1-107, pls. 1-15, text fig., graphs 1-6, map, July, 1936. (Included in the above: Queensland Cobra or Shipworms. A Systematic Account of the Teredinid Molluscs of South Queensland (by T.I. alone), pp. 31-44, text fig., pls. 1 & 2). Reprinted by Govt. Printer, Brisbane: 1-14, pls. i-ii, "July"=September 4, 1936.
209. List of Papers by Charles Hedley.
Proc. Linn. Soc. New South Wales, 61: 214-220, September 15, 1936.
210. C. M. N. White on Australian Birds.
Emu, 36: 136-137, October 1, 1936.
211. Book Review: "The Birds of the Malay Peninsula. Vol. III. Sporting Birds; etc."
Emu, 36: 143-144, October 1, 1936.
212. Destruction of Timber by Marine Organisms in the Port of Sydney. Supplementary Report No. 1, 1936. (R. A. Johnson, F. A. McNeill, and T.I.).
8vo. Publ. by The Maritime Services Board of New South Wales, Sydney, pp. 1-99, text figs., graphs, October 23, 1936.
(Reprinted in *The Dock and Harbour Authority* (London), 17(202), Aug. 1937, : 267 and 289-291, 4 figs., August, 1937; *Ibid.* 17(203): 317-319, 5 figs., September, 1937).

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213. On the Dict. Univ. D'Hist. Nat. of D'Orbigny.
Journ. Soc. Bibliogr. Nat. Hist., 1: 33-34, February 15, 1937.
214. The Middleton and Elizabeth Reefs, South Pacific Ocean. Mollusca.
Australian Zoologist, 8: 232-261, pls. 15-17, March 12, 1937.
215. A Basic List of the Land Mollusca of Australia. (See Nos. 225 & 237 below).
Australian Zoologist, 8: 287-333, map, March 12, 1937.
216. The Identity of Cook's Kangaroo. (T.I. and E. le G. Troughton).
Rec. Australian Museum, 20: 67-71, May 15, 1937.
217. Ornithological Section Annual Report. (T.I. and Roy Cooper).
Proc. Roy. Zoo. Soc. New South Wales, 1936-37: 18-20, August, 1937.
218. The Frost-Fish.
Angling and Gun Sport, 3, No. 1: 6, fig. on page 14, August, 1937.
219. Notes on Neozelanic Deepwater Marine Mollusca.
Rec. Australian Museum, 20: 103-107, pl. 17, August 27, 1937.
220. Rediscovery of *Voluta brazieri* Cox.
Rec. Australian Museum, 20: 128-129, August 27, 1937.
221. *Embrikena*, a new Genus of the Family Conidae (Phylum Mollusca).
Festschr. 60. Geburtstage Embrik Strand (Riga), 3: 406-408, pl. 18, September 11, 1937.
222. The Truth About the Museum Calonnianum.
Festschr. 60. Geburtstage Embrik Strand (Riga), 3: 408-419, September 11, 1937.
223. An Annotated Check List of the Land Shells of South and Central Australia.
South Australian Naturalist, 18: 6-56, pls. 1 & 2, map on page 7, and index of 2 pages inserted before frontispiece to volume, September 30, 1937.
- 223A. Faunal Protection Conference.
Angling and Gun Sport 3(2): 25, Sept. 30, 1937.
224. J. R. & G. Forster, Naturalists.
Emu, 37: 95-99, October 1, 1937.

225. A Basic List of the Land Mollusca of Australia—Part 2.
Australian Zoologist, 9: 1-39, pls. 1-3, November 12, 1937.
226. The Last Letters of John MacGillivray.
Australian Zoologist, 9: 40-63, pls. 4 & 5, November 12, 1937.
- 1938
227. The Question of Species.
Emu, 37: 179-181, January 1, 1938.
228. Book Review: "B.A.N.Z. Antarctic Research Expedition, 1929-31. Reports, Series B, Vol. 1: "Birds" by R. A. Falla, M.A. . . .".
Emu, 37: 243-245, January 1, 1938.
- 228A. Nature's Wonderland.
Auckland Weekly News, April 27, 1938:58.
- 228B. Harbour mussels "good for eating". Scientist attacks health regulations.
Sydney Morning Herald, May 4, 1938, p. 21.
229. The Fluvifaunulae of Australia. (T.I. and G. P. Whitley).
South Australian Naturalist, 18: 64-68, map, "April 30" (=mid May), 1938.
230. William Anderson—Ornithologist.
Emu, 38: 60-62, July, 1938.
231. Australian Avifaunal Problems.
Australian Journ. Sci., 1: 20-22, August 22, 1938.
(Reprinted in *Proc. Roy. Zoo. Soc. New South Wales*, 1937-38: 7-9, August 26, 1938).
232. Operculum of *Turbo pulcher* Reeve.
Journ. of Conchol., 21: 65, September 22, 1938.
233. *Clanculus howinsulae* Salisbury.
Journ. of Conchol., 21: 65, September 22, 1938.
234. John Gould: The Bird Man.
Emu, 38: 90-95, October, 1938.
235. Gould as a Systematist. (G. M. Mathews and T.I.).
Emu, 38: 172-175, October, 1938.
236. Book Review: "Australian Parrots; Their Habits in the Field and Aviary, by Neville W. Cayley."
Australian Museum Mag., 6: 396, November 8, 1938.
237. A Basic List of the Land Mollusca of Australia—Part 3.
Australian Zoologist, 9: 83-124, pls. 12 & 13, November 30, 1938.
The three parts of "A Basic List of the Land Mollusca of Australia" were issued together as *Austr. Zool. Handbook*, (Roy. Zool. Soc. N.S.Wales, Sydney), 5, 1938.
238. *Raja whitleyi*, The Great Skate.
Australian Zoologist, 9: 169, November 30, 1938.
239. A New Name for an Old Shell.
Australian Zoologist, 9: 172, November 30, 1938.
240. Book Review: "The Molluscs of South Australia."
Australian Zoologist, 9: 190, November 30, 1938 (and another in *Australian Journ. Sci.*, 1: 104, December 21, 1938).
241. The Faunal Divisions of Western Australia.
Australian Journ. Sci., 1: 102-103, December 21, 1938.
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242. The Sea Birds of Sydney Harbour.
Maritime Services Board Officers' Journ., 14, No. 8: 9-12, January, 1939; *Ibid*, 14, No. 9: 9-12, February, 1939.
243. Destruction of Maritime Timberwork in Australia. Review of Experiments dealing with Timber Destruction in Brisbane Waters, Queensland, Australia. [By T.I. and others].
The Dock and Harbour Authority (London), 19: 97-100, 9 text figs., February, 1939.
244. Mollusca. Part 1.
Great Barrier Reef Expedition, 1928-29, Sci. Reports, 5: 209-425, pls. 1-7, map, February 25, 1939.

245. The Eclipse Plumage of the Elfin Wren, (*Ryania melanocephala*).
Emu, 39: 39-40, July, 1939.
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Journ. de Conchyl., 83: 243-244, August 12, 1939.
248. Royal Zoological Society of New South Wales. Fifty-ninth Annual Report.
Proc. Roy. Zoo. Soc. New South Wales, 1938-39: 1-4, August 24, 1939. (Also the Sixtieth and Sixty-first in ensuing years).
249. A Review of the Relationships of the Mollusca of Lord Howe Island. (J. Allan and T.I.)
Rept. Austr. New Zeal. Assoc. Adv. Sci. (Canberra, 1939), 24: 113, December, 1939.
250. Australian Cowries, Part 2.
Australian Zoologist, 9: 297-323, pls. 27-29, December 12, 1939.

1940

- 250A. Marine Faunal Regions of Australasia (By G. P. Whitley & T.I.).
[Title only of paper for 6th Pacific Science Congress, San Francisco].
Austr. Mus. Ann. Rept., 1939: 1, 1940.
251. Guide to the Land Shells of New South Wales.
Australian Naturalist, 10: 227-236, text figs. 1-3, May 30, 1940. (See No. 264 below).
252. A New Guinea Land Shell in Queensland.
Australian Naturalist, 10: 239-240, 1 text fig., May 30, 1940.
253. The Land-Shell *Hedleya*.
North Queensland Naturalist, 8, No. 62: 1-2, 1 text fig., June 1, 1940.
254. The Work of Gregory Mathews, Ornithologist.
Proc. Roy. Zoo. Soc. New South Wales, 1939-40: 31-33, portrait, August 19, 1940. (Reprinted with altered title, and without portrait or first paragraph in *Birds and Books* (by G. M. Mathews), Canberra, pp. 7-10, December, 1942).
255. *Glaucus*, A Mystery of the Sea.
Proc. Roy. Zoo. Soc. New South Wales, 1939-40: 40-41, August 19, 1940.
256. Review: Sharks!!
Proc. Roy. Zoo. Soc. New South Wales, 1939-40: 41, August 19, 1940. (Reprinted in *Australian Zoologist*, 9: 451, December 9, 1940).
257. Recent Palaeoconchology.
Australian Journ. Sci., 3: 9-11, August 21, 1940.
258. All About Sharks. A Novel Book on the Subject. (Book Review).
Angling and Gun Sport, 6, No. 2: 22-24, 4 text figs., September 30, 1940.
259. Australian Skuas.
Emu, 40: 177-180, pl. 37, October 5, 1940.
260. Australian *Glaucus*.
Australian Zoologist, 9: 428, text fig., December 9, 1940.
261. Marine Molluscs from Lord Howe Island, Norfolk Island, Australia and New Caledonia.
Australian Zoologist, 9: 429-443, pls. 32-34, December 9, 1940.
262. Bali Shells.
Australian Zoologist, 9: 443, December 9, 1940.
263. A Review of the Relationships of the Mollusca of Lord Howe Island. (T.I. and Joyce Allan).
Australian Zoologist, 9: 444-451, map, December 9, 1940.

1941

264. Guide to the Land Shells of New South Wales. Part 2.
Australian Naturalist, 10: 262-269, text figs. 4-6, April 16, 1941.

265. Book Review: "The Molluscs of South Australia. Part 2."
Australian Journ. Sci., 3: 135, April, 1941. (And another in *Proc. Roy. Zoo. Soc. New South Wales*, 1940-41; 35, August 11, 1941).
266. Obituary. Edwin Ashby.
Proc. Roy. Zoo. Soc. New South Wales, 1940-41: 45, August 11, 1941 (Anonymous).
267. Guide to the Land Shells of New South Wales. Part 3.
Australian Naturalist, 11: 1-8, text figs. 7 & 8, December 19, 1941.
268. A Basic List of the Land Mollusca of Papua.
Australian Zoologist, 10: 51-94, pls. 3-5, December 19, 1941.

1942

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Australian Museum Mag., 7: 422, March 16, 1942.
270. Report on Molluscan Content of Heron Island Reef Boring Samples.
Report Great Barrier Reef Committee, 5, Appendix 2: 120-122, April 30, 1942.
271. Guide to the Land Shells of New South Wales. Part 4.
Australian Naturalist, 11: 33-40, text figs. 9-11, June, 1942.
272. Description of a Libyan Desert Land Shell.
Rec. Australian Museum, 21: 126, July 8, 1942.
273. Book Review: "Australian Insects. An Introductory Handbook, by K. C. McKeown."
Proc. Roy. Zoo. Soc. New South Wales, 1941-42: 33-34, September 25, 1942.
- 273A. Introduction: The Work of Gregory Mathews. In *Birds and Books* by G. M. Mathews (Canberra): 7-10, Dec. 1942. [See no. 254, above].

1943

274. Plain Dwellers and Mound Builders, The *Pedionomus* Puzzle. (T.I. and G. P. Whitley).
Emu, 42: 246-249, April 1, 1943.
275. Guide to the Land Shells of New South Wales. Part 5.
Australian Naturalist, 11: 61-69, text figs. 1-4, April 2, 1943.
276. The *Citloceras* Problem.
Australian Zoologist, 10: 166, April 30, 1943.
277. A Basic List of the Fresh Water Mollusca of Australia.
Australian Zoologist, 10: 188-230, April 30, 1943.
278. A New *Amphidromus* from Burma.
Nautilus, 57: 16, pl. 6, fig. 5, July, 1943.
279. Guide to the Freshwater Shells of New South Wales. Part 1.
Australian Naturalist, 11: 85-95, text figs. 1-3, November, 1943.

1944

280. The "Gundlachia" Puzzle.
Australian Zoologist, 10: 290, May 10, 1944.
281. Australian Pearly Nautilus.
Australian Zoologist, 10: 294-298, 2 text figs., May 10, 1944.
282. The Land Mollusca of Lord Howe Island.
Australian Zoologist, 10: 299-334, pls. 17-20, May 10, 1944.
- 282A. Some aspects of the natural history of New Guinea. 3. Birds and Shells.
Abstr. Proc. Linn. Soc. N.S.Wales, 560: first and second pages, June 2, 1944. *Proc. Linn. Soc. N.S.Wales* 49: xxi, 1944.
283. Guide to the Freshwater Shells of New South Wales. Class Gastropoda. Part 2.
Australian Naturalist, 11: 113-127, text figs. 4-8, August, 1944.
284. Winter-breeding Sea-Birds.
Proc. Roy. Zoo. Soc. New South Wales, 1943-44: 19-20, August 31, 1944.

285. More About New Guinea Land Shells.
Proc. Roy. Zoo. Soc. New South Wales, 1943-44: 30, August 31, 1944.

1945

- 285A. [Book Review]: "The Story of Elizabeth Gould", by Alec. H. Chisholm.
Austr. Mus. Mag., 8(11), March-May, 1945: 378, May 31, 1945.
 286. The Land Mollusca of Norfolk Island.
Australian Zoologist, 11: 46-71, pls. 2-5, June 11, 1945.
 287. Jules Verreaux.
Australian Zoologist, 11: 71-72, June 11, 1945.
 288. Harry Burrell. (Obituary Notice).
Proc. Roy. Zoo. Soc. New South Wales, 1944-45: 11, August 31, 1945.
 289. Obituary. Mr. A. F. Basset Hull.
Wild Life (Melbourne), 7: 377-378, December, 1945.

1946

290. A New Australian Parrot.
Emu, 46: 1-2, pl. 1, July, 1946.
 291. Royal Zoological Society of New South Wales. Sixty-sixth Annual Report.
Proc. Roy. Zoo. Soc. New South Wales, 1945-46: 1-3, October 30, 1946.
 292. Sidney W. Jackson. (Obituary Notice).
Proc. Roy. Zoo. Soc. New South Wales, 1945-46: 16, October 30, 1946.
 293. The Mathewsian Library at Canberra.
Proc. Roy. Zoo. Soc. New South Wales, 1945-46: 28, October 30, 1946.

1947

294. Book Review: "Gliders of the Gum Trees."
Proc. Roy. Zoo. Soc. New South Wales, 1946-47: 5, September, 1947.
 295. The Scientific Name of the Dingo.
Proc. Roy. Zoo. Soc. New South Wales, 1946-47: 35-36, September, 1947.

1948

296. A Check List of the Birds of Paradise and Bower Birds.
Australian Zoologist, 11: 161-189, February 11, 1948.
 297. "Love's Meinie."
Australian Zoologist, 11: 204-206, February 11, 1948.
 298. Bullock's Museum.
Australian Zoologist, 11: 233-237, pls. 16-18, text fig., February 11, 1948.
 299. H.M.S. "Endeavour Bark."
Australian Museum Mag., 9: 289-293, cover, frontispiece, 1 text fig., December 31, 1948.

1949

300. Western Australian Molluscs.
Proc. Roy. Zoo. Soc. New South Wales, 1947-48: 18-20, "January" (=February 14), 1949.
 300A. [Brief account of the history and status of some of the bower-birds, and those of New Guinea in particular].
 In N. Chaffer, "Notes on two New Guinea Bower-birds." *The Emu* 49: 20-22 and description of egg on p. 24, August 31, 1949.

1950

301. The Marine Mollusca of New Caledonia.
Journ. de Conchyl., 90: 52-55, January 15, 1950.
302. Birds of Paradise and Bower Birds.
Georgian House, Melbourne, pp. I-XII, 1-239, pls. 1-33, orig. illustr. on cover, folding map, May 8, 1950.
303. Gregory M. Mathews (1876-1949). (Obituary Notice).
Proc. Roy. Zoo. Soc. New South Wales, 1948-49: 16-20, portrait, May 29, 1950.

1951

304. Moas.
Proc. Roy. Zoo. Soc. New South Wales, 1949-50: 69-70, April 2 1951.
305. Gould and Audubon.
Proc. Roy. Zoo. Soc. New South Wales, 1949-50: 70, April 2, 1951.
306. Book Review: "Australian Shells".
Proc. Roy. Zoo. Soc. New South Wales, 1949-50: 73-74, April 2, 1951.
307. The Humming Bird.
Australian Zoologist, 11: 314-315, July 31, 1951.
308. Again Gould. An Amazing Discovery.
Australian Zoologist, 11: 316-317, July 31, 1951.
309. Audubon in Australia.
Australian Zoologist, 11: 318-321, July 31, 1951.
310. Western Australian Bird Books.
Australian Zoologist, 11: 321, July 31, 1951.
311. The Naturalist's Library. An Essay in Bibliography.
Australian Zoologist, 11: 322-332, pls. 33 & 34, text fig., July 31, 1951.
312. Recent Palaeontology.
Australian Zoologist, 11: 347-350, July 31, 1951.
313. Birds of Paradise.
Australian Junior Encyclopaedia, Georgian House, Melbourne, Vol. 2: 808-809, pl. between pp. 812 & 813, August, 1951. See also no. 326A, below.
314. Australian Shells. (J. Allan, T.I. and B. C. Cotton).
Australian Junior Encyclopaedia, Georgian House, Melbourne, Vol. 2: 875-897, pl. 38 text figs., August, 1951. (Gastropods, The Volutes, Cone Shells, Trumpet Shells, Helmet Shells, Cowries, Collectors' Favourite, The Wonder Cowry, Chitons or Loricates, Freshwater Shells, Land Shells, Desert Snails, The Midgets and The Slugs by T.I.). See also no. 326B, below.

1952

315. Sea Birds of Sydney Harbour. Part 1.
Port of Sydney, 4: 24-27, 5 text figs., July, 1952.
316. Sea Birds of Sydney Harbour. Part 2.
Port of Sydney, 4: 50-54, 7 text figs., October, 1952. (Nos. 315 and 316 reprinted in 4 parts in *The Waratah* (Official Organ of the Girl Guides Assoc. of New South Wales), 33, No. 10: 6-7, 5 text figs., April, 1953; *Ibid*, 33, No. 11: 4-5, text fig., May, 1953; *Ibid*, 33, No. 12: 10-11, text fig., June, 1953; *Ibid*, 34, No. 3: 6-8, 5 text figs., September, 1953).

1954

317. Cuttle Fish "Bones" Again.
Australian Zoologist, 12: 63-82, pls. 4 & 5, March 24, 1954.
- 317A. J. Douglas Ogilby.
Biogr. Mem. Amer. Ornith. Union, by T. S. Palmer and others (Washington, 1954): 432. Reprinted from *The Auk*, no. 130, above, 1954.

1955

318. Bellingshausen in Australia.
Proc. Roy. Zoo. Soc. New South Wales, 1953-54: 34-36, March 4, 1955.
319. Bill Moults in Prions.
Proc. Roy. Zoo. Soc. New South Wales, 1953-54: 37, March 4, 1955.
320. On *Sepia cultrata* Hoyle.
Proc. Roy. Zoo. Soc. New South Wales, 1953-54: 78-79, March 4, 1955.
321. Rissoid Sectional Names.
Proc. Roy. Zoo. Soc. New South Wales, 1953-54: 81, March 4, 1955.
322. James Stuart—Ornithologist.
Australian Zoologist, 12: 127-128, pls. 7-9, 1 text fig., July 18, 1955.
323. Frioriep and Lamarck.
Australian Zoologist, 12: 175, July 18, 1955.

1956

324. Broinowski's Birds and Mammals of Australia.
Proc. Roy. Zoo. Soc. New South Wales, 1954-55: 14-16, April 10, 1956.
325. A Northern Australian Volute.
Proc. Roy. Zoo. Soc. New South Wales, 1954-55: 76-77, fig. 1, April 10, 1956.
326. History of New South Wales Shells. Part 1: Cook and His Associates.
Proc. Roy. Zoo. Soc. New South Wales, 1954-55: 81-83, 1 fig., April 10, 1956.
- 326A. Birds of Paradise.
Australian Junior Encyclopaedia (Revised edition [of no. 313, above] publ. by Australian Educational Foundation), Vol. 3: 808-809, and plate opp. p. 780. Sydney, 1956.
- 326B. Australian Shells (by J. Allan, T.I. & B. C. Cotton).
Australian Junior Encyclopaedia (Revised edition [of no. 314] publ. by Australian Educational Foundation), Vol. 3: 875-897, pl. & text-figs. Sydney, 1956.

1957

327. Birds of New Guinea.
(Georgian House, Melbourne, "1956" [posted from Melbourne, March 13, 1957]) Book, 8" by 10½". Vol. i, pp. i-xv + 1-230, coloured plates i-xv.
328. *Ibid.*, Vol. ii, pp. i-xv + 1-261, coloured plates xvi-xxxv and map at end.
[Two volumes in solander case. Since each volume is paged from 1 onwards, it is necessary to number them 327 and 328 here, for the easier indexing of the new names in them].
329. Another Australian Volute.
Proc. Roy. Zool. Soc. N.S.Wales, 1955-56: 91-92, plate. May 8, 1957.
330. The Systematic Status of *Ctiloceras* and some comparative genera. (By T.I. and C. F. Laseyron).
Proc. Roy. Zool. Soc. N.S.Wales, 1955-1956: 97-109, pls. i-ii, figs. 1-35, May 8, 1957.
331. An intriguing Volute.
Proc. Roy. Zool. Soc. N.S.Wales, 1955-56: 121-123, fig. 1. May 8, 1957.
332. An exciting Find.
Proc. Roy. Zool. Soc. N.S.Wales, 1955-56: 124-125, fig. 1. May 8, 1957.
333. History of New South Wales Shells. Part II. The Settlement Years.
Proc. Roy. Zool. Soc. N.S.Wales, 1955-56: 125-126, May 8, 1957.

1958

334. My friend Oliver.
Proc. Roy. Zool. Soc. N.S.Wales, 1956-57: 11-12, June 27, 1958.
- 334A. A tribute to Lilian Medland (Anon. = by T.I. & G. P. Whitley).
Proc. Roy. Zool. Soc. N.S.Wales, 1956-57: 13-14, fig., June 27, 1958.
335. A home-made book on Shells.
Proc. Roy. Zool. Soc. N.S.Wales, 1956-57: 58-61, fig. 1, June 27, 1958.
336. On the Thirteenth Edition of Linne's *Systema Naturae*.
Proc. Roy. Zool. Soc. N.S.Wales, 1956-57: 61-62, June 27, 1958.
337. A bibliography of Lee Woolacott with an index to her new scientific names. (By T.I. & G. P. Whitley).
Proc. Roy. Zool. Soc. N.S.Wales, 1956-57: 82-83 & fig., June 27, 1958.
338. To memorize Lee.
Proc. Roy. Zool. N.S.Wales, 1956-57: 84-85, 2 figs., June 27, 1958.
339. Brazier's "Cowries in Australasia".
Proc. Roy. Zool. Soc. N.S.Wales, 1956-57: 94-95, June 27, 1958.
340. Book Review . . . Cowries! Cowries!! Cowries!!!
Proc. Roy. Zool. Soc. N.S.Wales, 1956-57: 95-96, June 27, 1958.
341. Forbes and Australia.
Proc. Roy. Zool. Soc. N.S.Wales, 1956-57: 96-98, June 27, 1958.
342. Some molluscan name changes.
Proc. Roy. Zool. Soc. N.S.Wales, 1956-57: 103-104, June 27, 1958.
343. John (William) Brazier.
Proc. Roy. Zool. Soc. N.S.Wales, 1956-57: 105-118, June 27, 1958.
344. Charles Hedley's Papers Indexed.
Proc. Roy. Zool. Soc. N.S.Wales, 1956-57: 118-139, June 27, 1958.
345. History of New South Wales Shells. Part III. The Settlement Years (Continued): Thomas Watling, Artist.
Proc. Roy. Zool. Soc. N.S.Wales, 1956-57: 162-169, pls. i-iv, June 27, 1958.

1959

346. George French Angas: The Father of Australian Conchology.
Austr. Zool., 12(4): 362-371, Feb. 10, 1959.
347. Pilsbry the Master.
Austr. Zool., 12(4): 372, Feb. 10, 1959.
348. Captain Comtesse.
Austr. Zool., 12(4): 373, Feb. 10, 1959.
349. The Land and Freshwater Mollusca of Australia. (By D. F. McMichael and T.I.).
Biogeography and Ecology in Australia Monographiae Biologicae 8, Australia (W. Junk, Den Haag): 224-245, pls. i-ii, map 1 [September, 1959].

1962

350. A Reference List of the Marine Mollusca of New South Wales (By T.I. and D. F. McMichael).
Austr. Mus. Mem., 11:1-109, May 30, 1962.
351. John Roach and the Budgerigar (By T.I. and G. P. Whitley).
Austr. Nat. Hist., 14(3): 99-102, 2 figs, Sept. 21, 1962.
352. The actual identity of Captain Cook's Kangaroo (By T.I. and Ellis Troughton).
Abstr. Proc. Linn. Soc. N.S.Wales, 711, July 25 [published Aug. 1, 1962]: 1 and *Proc. Linn. Soc. N.S.Wales*, 87(2), 1962:177-184, 2 figs, Jan. 10, 1963.

1965

353. Sir William Denison as a conchologist. (By T.I. and G. P. Whitley).
Proc. Roy. Zool. Soc. N.S.Wales, 1964-65: 27-30, Dec. 17, 1965.
354. Forster, Johann Reinhold (1729-1798).
Australian Dictionary of Biography (Melbourne Univ. Press), 1,
 1788-1850 A-H: 403-404, March 3, 1966.

1968

355. The Circular Head Scientific Journal and some other early Tasmanian natural history manuscripts. (By Tom Iredale & G. P. Whitley).
Australian Zoologist, 14(3): 257-258, July 5, 1968.

1969

356. Roy Bell (1882-1966).
Proc. Roy. Zool. Soc. N.S.Wales, 1967-68: 18-20, pl. ii, April 24, 1969. Reprinted, without pagination, 3 pp. & pl. II, September 1969.
357. Charles Hedley.
Proc. Roy. Zool. Soc. N.S.Wales, 1967-68: 26-31, April 24, 1969.
358. Captain Abel D. W. Best (1816-1845), a soldier-naturalist and his diaries. (By Tom Iredale & G. P. Whitley).
Proc. Roy. Zool. Soc. N.S.Wales, 1967-68: 32-37, April 24, 1969.
359. Chesnon's "Essai sur l'histoire naturelle," 1835. (By Tom Iredale & G. P. Whitley).
Proc. Roy. Zool. Soc. N.S.Wales, 1967-68: 43-45, April 24, 1969.

1970

360. John Roach, the budgerigar, and the unfortunate officer. (By T. Iredale & G. P. Whitley).
Proc. Roy. Zool. Soc. N.S.Wales, 1968-69: 36-39, February 27, 1970.
361. [Book Review] "Small birds of the New Zealand Bush," by E. Power (Reviewed by T. Iredale & G. P. Whitley).
Austr. Zool., 15(3), Aug. 12, 1970, p. 406.

1971

362. Serpents of the Sea.
Austr. Zool., 16(2), Sept. 24, 1971, pp. 19-24 = *Proc. Roy. Zool. Soc. N.S.Wales*, 1969-70 (Sept. 24, 1971), pp. 19-24.

1972

363. Early work on Australian ascidians (by [T.I. and] G. P. Whitley).
Austr. Mar. Sci. Bull., July 1972: 3 (title only *et ibid.*, 40:13, Oct. 1972 and in press).

LIST OF NEW NAMES

In the following list, all the new generic, subgeneric, specific and subspecific names proposed by Iredale (including those in collaboration with other authors) are in alphabetical order. In each case, the generic name following a species name, or the generic and specific names following a subspecific name, are those under which combinations were originally proposed. Mammals, birds, fishes, molluscs, crustacea and perhaps other groups of animals are included indiscriminately. The first number following each name is that of the paper in the foregoing bibliography in which the name was first proposed; the second is the number of the page in that book or paper where it first occurs. Where two page-numbers are given, the second may give additional information such as a description or a selection of a type-species.

Preoccupied generic names

All of Iredale's new generic and subgeneric names have been checked with Neave's *Nomenclator Zoologicus* (six volumes, including corrigenda and supplements, published between 1945 and 1966). His few preoccupied names of mollusca (listed by McMichael & Whitley, *Austr. Zool.*, 12(3), 1956: 211) have been replaced by others, the latest substitutes being:- *Allenella* (= *Allentula* Iredale, 1958), *Sheba* (= *Parvisheba* Iredale, 1958), and *Vacerra* (= *Vacerrena* Iredale, 1958).

Carinocera Iredale & Laseron, 1957, is uncomfortably close to *Carinoceras* Lyashenko, proposed in the same year for a fossil mollusc, but seems to be saved by one letter.

Unrecorded names

All of the 83 "unrecorded names" (i.e. those not then indexed by nomenclators) of Iredale (and his associates) listed by McMichael & Whitley (*loc. cit.*, 1956: 211-212) have now been included in the *Zoological Records* or in Neave's *Nomenclator Zoologicus*, vols. 5 & 6. It is noteworthy, however, that Iredale's new generic names for birds, clearly proposed in his *Birds of New Guinea* in 1957 have not (at least up to 1968) been picked up by the *Zoological Record*. Also *Allentula*, *Contramelon* and *Fluvidona* in Mollusca have been missed by nomenclators. No doubt these will all appear in the seventh volume of the *Nomenclator Zoologicus*, since a list of them has been handed to the compilers of that invaluable work at Regent's Park, London. Meanwhile, the names still seemingly unrecorded are:

Aleadryas, *Allentula*, *Caligavus*, *Capricia*, *Charminetta*, *Contramelon*, *Drymodina*, *Fluvidona*, *Garritornis*, *Labeothello*, *Melionyx*, *Misophaps*, *Mollitor*, *Moniapura*, *Mundavis*, *Mutevodtia*, *Ornorectes*, *Papuodytes* and *Umbrixos*.

- | | |
|---|---|
| aberrans, <i>Innesoconcha</i> , 282: 326. | adjacens, <i>Acanthosepion ellipticum</i> , 137: 239. |
| abiten, <i>Tasmadelos nelsonensis</i> , 237: 118. | adjacens, <i>Maellarca dautzenbergi</i> , 244: 265. |
| abjecta, <i>Paralaoma</i> , 282: 311. | adjuncta, <i>Letitia</i> , 268: 78. |
| Abranda, 116: 182 & 212. | adjuncta, <i>Limborelia innesi</i> , 282: 302. |
| abstans, <i>Pleuroxia</i> , 246: 56. | adjunctus, <i>Ratifusus</i> , 163: 183. |
| <i>Acanthozostera</i> , 138: 263. | adjunctus, <i>Velesunio balonnensis</i> , 196: 59. |
| accessa, <i>Setaliris</i> , 169: 388. | aegrifer, <i>Simlimnea</i> , 283: 119. |
| acervus, <i>Triellsiphon</i> , 261: 439. | aenigma, <i>Acanthochiton</i> , 128: 87. |
| <i>Acritopaphia</i> , 207: 280. | aetha, <i>Semelartermis</i> , 171: 76. |
| acroporicola, <i>Coralichlamys</i> , 244: 356. | <i>Aethocola</i> , 53: 465. |
| actaviva, <i>Oblimopa macgillivrayi</i> , 244: 242. | <i>Afrocominella</i> , 70: 28 & 34. |
| <i>Acuticylindra</i> , 160: 287. | agnitum, <i>Phalium</i> , 143: 332. |
| <i>Adamnestia</i> , 207: 333. | agripeta, <i>Modiolus</i> , 244: 412. |
| addenda, <i>Ellatrivia (merces)</i> , 179: 221. | ahena, <i>Paralaoma</i> , 286: 54. |
| addenda, <i>Lophorina superba</i> , 296: 162. | aladdin, <i>Navicula</i> , 244: 292. |
| addenda, <i>Notoplax speciosa</i> , 128: 91. | <i>Alathyria</i> , 196: 63. |
| addenda, <i>Palmatina</i> , 286: 50. | albidus, <i>Favorinus</i> , 99: 197 & 205. |
| addita, <i>Anadara</i> , 244: 280. | albisoror, <i>Parviperna</i> , 244: 323. |
| addita, <i>Dominamaria</i> , 268: 58. | alea, <i>Frustrupa</i> , 286: 58. |
| addita, <i>Hedleyoconcha</i> , 282: 317. | <i>Aleadryas</i> , 328: 106. |
| addita, <i>Trisidos tortuosa</i> , 244: 272. | <i>Aleatelix</i> , 268: 86. |
| adelaideana, <i>Microcucullaea</i> , 163: 159. | alexanderi, <i>Heteroprion desolatus</i> , 80: 42. |
| adelaideana, <i>Prothyasira</i> , 169: 393. | aliena, <i>Sanhaliotis varia</i> , 160: 270. |
| adhaesa, <i>Solitosepia plangon</i> , 137: 238. | aliena <i>Scapharca</i> , 244: 282. |
| | <i>Alienitor</i> , 225: 6. |
| | allanae, <i>Coralastele</i> , 171: 76. |

- Allanassa, 160: 289.
 allani, Pedinoysgra, 225: 16.
 Allenella, 282: 311. (Preoccupied name).
 alleni, Alathyria jacksoni, 277: 89.
 alleni, Galadistes, 275: 62.
 Allentula, 242: 103.
 Allisma, 368: 62.
 Allocharopa, 215: 326.
 alma, Pardosinia, 160: 265.
 alma, Tribocystis, 282: 324.
 alphenia, Segnitila, 277: 227.
 alpica, Strangesta, 275: 68.
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⁽¹⁾ This name was originally introduced by S. W. Jackson in *Bank Notes*, 15(11): 17, 1933, which was not a scientific publication. Iredale introduced the name and figured the species as a synonym of *B. fuscus* Thiele, thereby becoming author of *franki*.

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⁽¹⁵⁾ Originally described as *Lyria deliciosa howensis* in 1937, this taxon was later (1940) redescribed (by oversight) as a new full species.

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⁽¹⁰⁾ Also written as T. [mccoyi] interpres, p. 272.

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⁽¹⁷⁾ Iredale introduced this manuscript name of John Macgillivray's for a genus of bats. The name is preoccupied so has been allowed to lapse.

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THE EASTERN AUSTRALIAN, BURROWING MUD-SHRIMP
LAOMEDIA HEALYI (CRUSTACEA, MACRURA REPTANTIA,
LAOMEDIIDAE) WITH NOTES ON LARVAE OF THE
GENUS **LAOMEDIA**

by

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(Plates VI-VII; figs. 1-20)

INTRODUCTION

In volume 15 part 3 of this journal a preliminary description was published of a new thalassinid shrimp of the family Laomeidiidae from eastern Australian shallow waters (Yaldwyn & Wear, 1970). A preliminary account, with a systematically available new name, became necessary as a colour plate of the new species was due to appear in a general publication on Australian crustaceans (Healy & Yaldwyn, 1970) before the full description and figures presented here could be completed for the *Australian Zoologist*. The species concerned is *Laomedia healyi* Yaldwyn and Wear, 1970, a relatively large, burrowing mud-shrimp known from mangrove swamps, and from subtidal channels draining such swamps, along the eastern Australian coastline between northern Queensland and central New South Wales.

Listed as an unidentified axiid in the Australian Museum collections, where specimens have been accumulating since last century, *L. healyi* was first recognized as a new laomeidiid by T. S. Hailstone of the University of Queensland (see Australian Museum files) and then recorded as an undescribed *Laomedia* by Wear and Yaldwyn (1966: 2, 3). The genus *Laomedia*, upon which the poorly-known family Laomeidiidae is based, is apparently restricted to the Indopacific where the only other described member is *Laomedia astacina* de Haan, 1841, from Japan, Korea and the Ryukyu Islands (see Sakai, 1962, for general account). *L. astacina* is a burrowing form, known from intertidal and estuarine areas where they have been described as "hollowers in the muddy sand of tidal zone, their openings of holes circling around with piled sand" (Sakai, 1962: 30).

A third species of *Laomedia*, at present undescribed, was recognized by us during this study of *L. healyi*. A single ovigerous female thalassinid, small in size and pale yellow in colour, was collected by one of us (J.C.Y.) from a *Sesarma* (marsh crab) burrow system in the muddy bank of a mangrove-lined stretch of the Barron River, near Cairns, Northern Queensland. It is a true *Laomedia*, but differs in a number of features from the (?) relatively larger, pink *L. healyi*, which was also collected from the same complex and extensive burrow system together with gobies, alpheid shrimps and two species of *Sesarma* (family Grapsidae). This undescribed *Laomedia* from northern Queensland (carapace length 9.5 mm, Australian Museum P.18362) will be referred to as "*Laomedia* n.sp. (Barron River)" in the text and table below. An illustrated account of this new form will be published later.

A laomediid larval series was described by Dakin and Colefax (1940) from Sydney Harbour and regarded by them and later workers (Wear & Yaldwyn, 1966: 19) as representing an unnamed, and unknown in the adult stage, eastern Australian species of the laomediid genus *Jaxea*. The possibility that this Sydney larval series could be the larvae of *Laomedea healyi* led one of us (R.G.W.) to obtain known first stage zoea larvae of *L. astacina* from Japan in order to establish the identity of larvae of the genus *Laomedea* with certainty. It was found that the Japanese larvae differ greatly from those of *Jaxea*, including the Dakin and Colefax series, and we must still assume that an unknown "Sydney" *Jaxea* adult species is present in eastern Australian waters. Every effort should be made to hatch larvae from ovigerous female *Laomedea healyi* thus confirming the generic characters of *Laomedea* larvae and directly establishing their distinction from the Dakin and Colefax "*Jaxea*" series.

The body of this paper is divided into two parts: the first, by both authors, is a detailed description of *L. healyi* and the second, by R.G.W. alone, consists of observations and comments on the relationships of larvae of the genus *Laomedea*. All drawings in both parts were done by R.G.W., all photographs were taken by Anthony Healy, Sydney.

PART 1. DESCRIPTION OF *LAOMEDIA HEALYI* WITH NOTES ON DISTRIBUTION AND HABITS

In the present account, as in Wear and Yaldwyn (1966), the laomediid genera and their thalassinid allies are regarded as belonging to the supersection *Macrura Reptantia* and their relationship to the *Anomura* will not be considered.

Order DECAPODA

Supersection MACRURA REPTANTIA

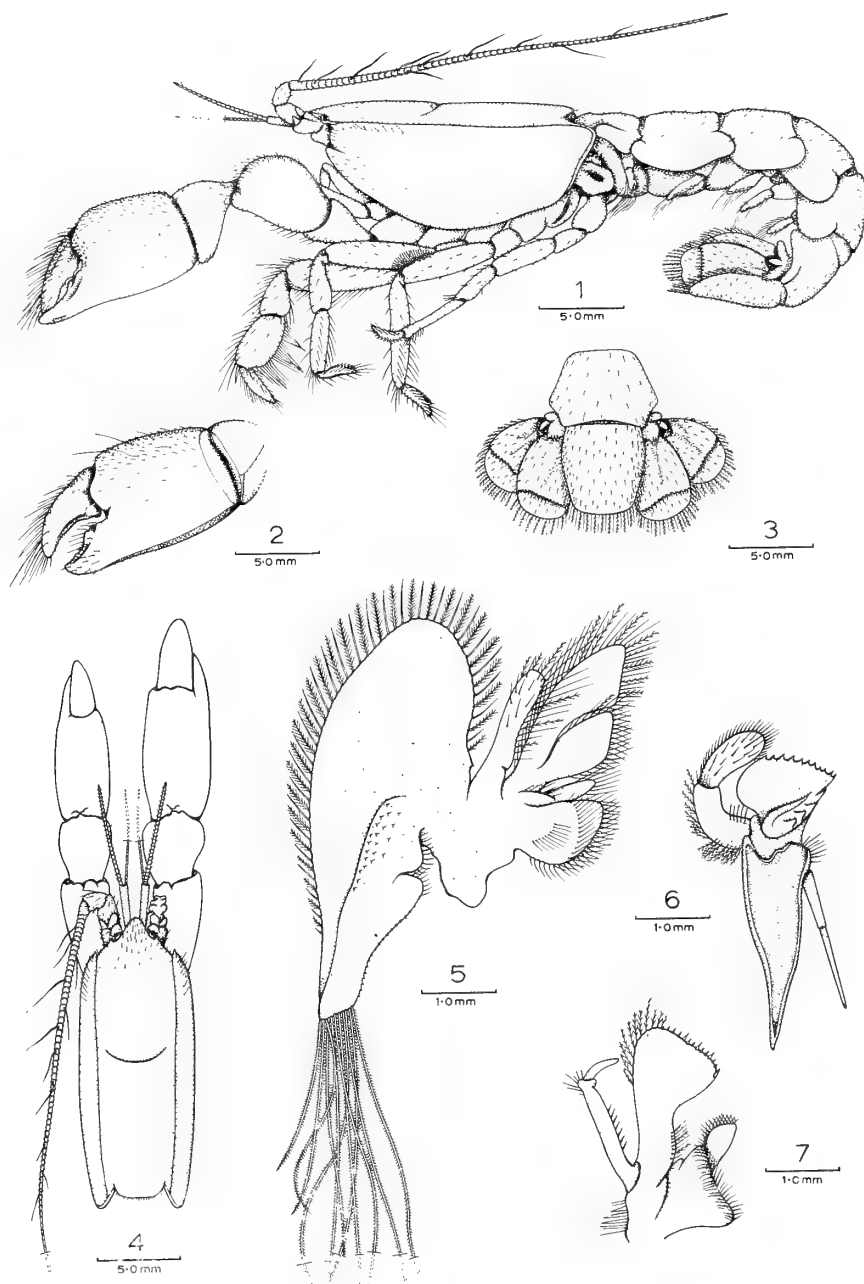
Section THALASSINIDEA

Seven families are currently placed in this section (for detailed discussion and key see Gurney, 1938: 339-343), these are the Callianassidae (Australian genera *Callianassa*, *Trypaea* and *Ctenocheles*), Callianideidae, Upogebiidae (Australian genus *Upogebia*), Axiidae (Australian genera *Axius* and *Axiopsis*), Axianassidae, Laomedidae (Australian genera *Laomedea* and, known only from larval series as yet, *Jaxea* and *Naushonia*) as well as the Thalassinidae (Australian genus *Thalassina*). As summarized by us previously (1966: 2) thalassinids (the seven-family section) are all apparently burrowing forms characterized by:- a reasonably well calcified, compressed carapace; a symmetrical, extended, often feebly calcified abdomen terminating in a well developed tail fan; the first pair of legs chelate or subchelate, second chelate, subchelate or simple, and third legs always non-chelate.

Family LAOMEDIIDAE Borradaile, 1903

The Laomedidae consists of three thalassinid genera having:- a *linea thalassinica* (a transverse, hinged groove along each side of the carapace) present; 1st pereopods subequal (in shape and form, but not necessarily in size), and chelate or subchelate; 2nd pereopods subchelate or simple, never chelate; no appendix interna on pleopods; uropods with transverse suture on both endopod and exopod; podobranch on at least 2nd and 3rd maxillipeds and 1st and 2nd pereopods, and epipods on 1st to 4th pereopods.

A key to the three known laomediid genera is given in Wear and Yaldwyn (1966: 3). No modifications can be made to that key and the footnote comments are all confirmed by this more detailed study of the eastern Australian *Laomedea healyi*. Although the 5th pereopod of *L. healyi* can be described as "subchelate", it is not strongly so and the significance of this feature in the key is probably overstressed.



Figures 1-7—*Laomedia healyi* Yaldwyn & Wear, holotype, adult female; Fig. 1, whole animal, lateral view; Fig. 2, right chela, medial view; Fig. 3, 6th abdominal segment, uropods and telson, dorsal view; Fig. 4, carapace, cephalic appendages and chelipeds, dorsal view; Fig. 5, left 2nd maxilla; Fig. 6, left mandible; Fig. 7, left 1st maxilla.

Genus *Laomedia* de Haan in Siebold, 1841
Laomedia de Haan, 1841: 162, 164.
Laomedia Borradaile, 1903: 540.
Laomedia Wear and Yaldwyn, 1966: 2.
 Not *Laomedia* Hassall, 1841, an incorrect subsequent spelling of *Laomedea* Lamouroux, 1812.

To establish the nomenclatural status of the generic name *Laomedia* de Haan three points need to be discussed—date of publication, status of *Laomedia* Hassall and significance of *Laomedea* Lamouroux.

(a) *Date of publication of LAOMEDIA de Haan.*

De Haan's volume on Crustacea in von Siebold's *Fauna Japonica* was published in a series of parts between 1833 and 1850. Holthuis (1953) and Holthuis and Sakai (1970: 77) give a table of dates for these parts and a list of the text pages and plates which made up each part. From this table it can be seen that the generic name *Laomedia* in the key on de Haan's page 162, the formal use of the generic name in the text followed by the first few lines of the generic description on page 164 and plate 35 with the name "*Laomedia astacina* n.sp." in the caption were all published in 1841. However, the remainder of the generic description followed by the formal use of the specific name in the text and the specific description, all on page 165, were not published till 1849. As the generic name *Laomedia*, part of the generic description, and figures of an included species associated with the specific name *astacina* were all available in 1841, we consider that both the genus *Laomedia* and the species *L. astacina* must be regarded as validly published in 1841, even though part of the generic description and the formal specific description did not appear till 1849. In the absence of any information as to when in 1841 pages 162, 164 and plate 35 appeared we must follow Article 21 of the *International Code of Zoological Nomenclature* (I.C.Z.N., 1964) and regard the generic name *Laomedia* de Haan as being available for nomenclatural purposes from the last day of the year 1841.

(b) *Status of LAOMEDIA Hassall.*

Neave included the name *Laomedia* Hassall, 1841, in his *Nomenclator Zoologicus* (1939) with the comment "(pro -dea Lamouroux 1812)". As Hassall's use of this name in *Ann. Mag. Nat. Hist.* VII (44): 281 can be dated to June 1841 it could have priority over *Laomedia* de Haan. However, it is clear that "*Laomedia*" Hassall, 1841, is an incorrect subsequent spelling of *Laomedea* Lamouroux, 1812, as in an earlier part of the same series of papers on "Irish Zoophytes" Hassall (1840: 169) used the spelling "*Laomedea*" twice without comment and associated it with the same specific name (*gelatinosa*) with which he used "*Laomedia*" without comment in 1841. Article 33b of the *International Code* (I.C.Z.N., 1964) states that an incorrect subsequent spelling has no status in nomenclature. Thus *Laomedia* Hassall, 1841, has no status in nomenclature and does not have priority over *Laomedia* de Haan.

(c) *Significance of LAOMEDEA Lamouroux.*

The existence of *Laomedea* Lamouroux, 1812 (used for a coelenterate) does not invalidate the subsequent use of *Laomedia* as a generic name. Article 56a of the *International Code* (I.C.Z.N., 1964) makes it clear that a single letter difference is sufficient to prevent homonymy. Neave (1939) also lists *Laomedia*, *Laomedaea*, *Laomedes* and *Laomomya* as subsequent spellings of *Laomedea* Lamouroux. None of these invalidates *Laomedia* de Haan.

The genus *Laomedia* consists of laomediids with a firm, white exoskeleton (the single small female *Laomedia* n.sp. "Barron Rive" has a relatively soft and translucent, rather than white, exoskeleton) and with setae of various lengths present on body and appendages (a close fur-like covering of very short

TABLE 1. Summary of differences between known species of *Laomedia*

Character	<i>L. astacina</i>	<i>L. healyi</i>	<i>L. n.sp.</i> (Barron River)
Antennal flagellum		"branches" present	?
Chela	free finger with outer (dorsal) edge rounded in section and bearing several irregular longitudinal rows of low tubercles under a dense mat of setae, deep groove along lateral face of finger	free finger with outer edge rounded in section and bearing a low crest of tubercles under a fringe of setae, shallow proximal groove on lateral face of finger	free finger with outer edge flattened, without tubercles but with a distinct angle between flattened surface and the (ungrooved) lateral and median faces of finger
Propodus of 2nd pereopod	flattened and expanded in lateral view with both dorsal and ventral margins convex	flattened and expanded in lateral view with both dorsal and ventral margins convex	flattened but not expanded in lateral view, both dorsal and ventral margins straight, segment slightly deeper proximally than distally
Telson	no longitudinal groove on dorsal surface, no teeth on lateral edge	a weak median longitudinal groove on dorsal surface, 3-4 indistinct teeth at midpoint of lateral edge	no longitudinal groove on dorsal surface, no teeth on lateral edge
Rostrum	about 4-6 small teeth on each side of rostrum behind terminal tooth	3-6 small teeth on each side behind terminal tooth	1 small tooth on each side behind terminal tooth
Anterolateral margin of carapace	small orbital spine above origin of <i>linea thalassinica</i> , but no antennal spine below <i>linea</i>	orbital spine above origin of <i>linea thalassinica</i> and a small antennal spine below <i>linea</i>	no orbital or antennal spines

setae as seen in *Jaxea* is not present). The *linea thalassinica* of the carapace is distinct and well developed. The eye is reduced but not hidden under the rostrum in dorsal view, cornea black. The peduncles of both the antennules and antennae are relatively short (penultimate segment of antennal peduncle up to one and half time length of ultimate). The scaphocerite is rudimentary but distinct (scaphocerite absent in the *Laomedea* n.sp. "Barron River" specimen). First maxilliped with flagellum on exopod but no podobranch. First pereopods subequal in shape and form (but often slightly unequal in size) with stout and heavy chelae, 2nd pereopod subchelate or simple, 5th pereopod (at least partially) subchelate. A single anthrobranch on 1st maxilliped and two on 2nd and 3rd maxillipeds and on 1st to 4th pereopods. Podobranchs on 2nd and 3rd maxillipeds and on 1st to 3rd pereopods. Male 1st pleopods absent, female 1st pleopods reduced and uniramous, 2nd to 5th pleopods biramous and similar in both sexes.

The type of the genus is *Laomedea astacina* de Haan, 1841, from Japan, Korea and the Ryukyu Islands. (Note: there is no trace of a podobranch on the 1st maxilliped of specimens of *L. astacina* from Japan examined by us—for discussion of this feature see Wear and Yaldwyn, 1966: 3).

As the only available specimen of *Laomedea* n.sp. (Barron River) has the flagella of both antennae missing and thus does not show the presence or absence of the distinctive hair-like "branches" so characteristic of *L. healyi* (see "description" below and pls VI & VII upper), a comparative table of differences is given for the three known species of *Laomedea* rather than a conventional key.

Laomedea healyi Yaldwyn and Wear, 1970
 "undescribed *Laomedea* from eastern Australia" Wear and Yaldwyn, 1966: 2, 3.
Laomedea healyi Yaldwyn and Wear, 1970: 384, fig. 1.
Laomedea healyi, Healy and Yaldwyn, 1970: 68, frontispiece.

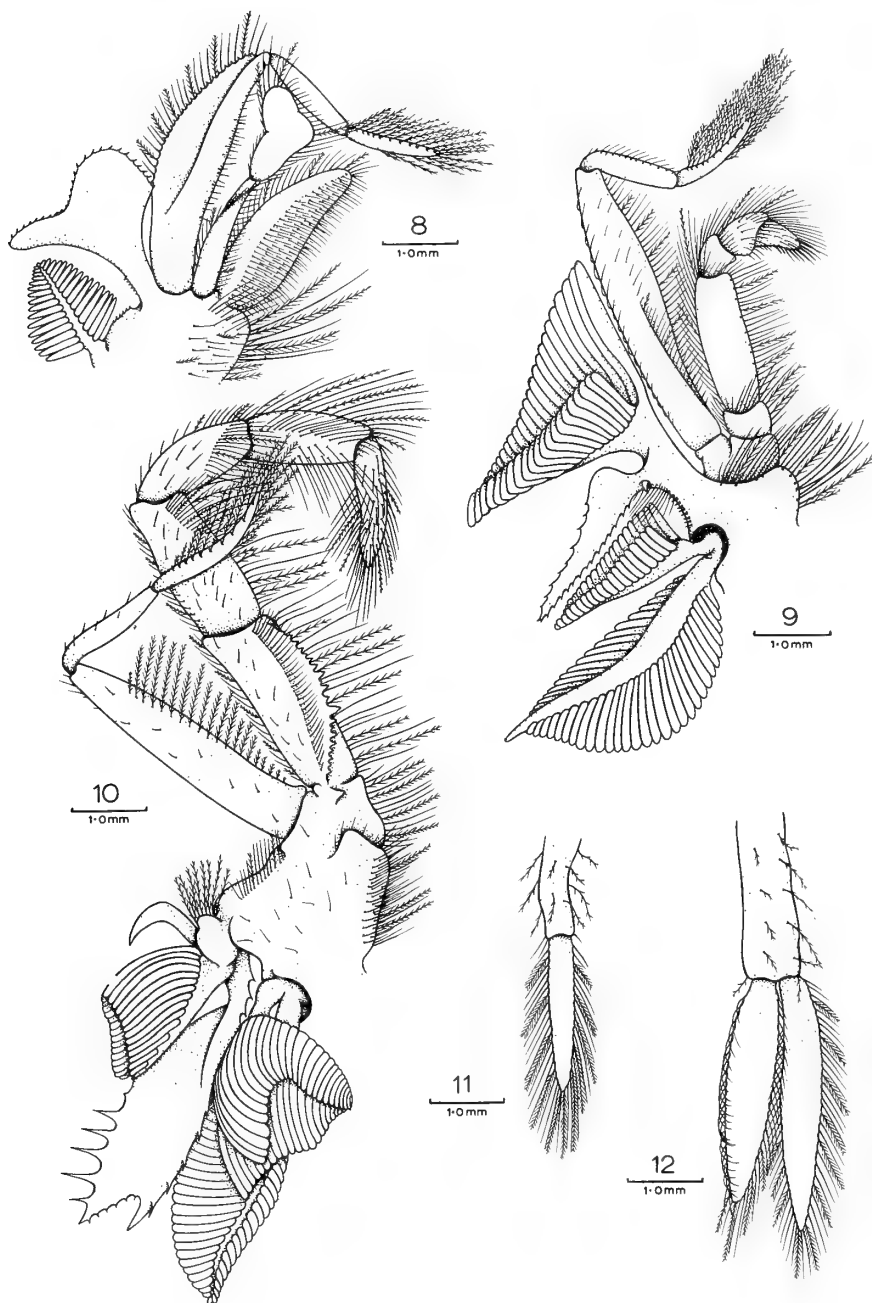
Material examined

Queensland: Barron River, near Cairns, from *Sesarma* burrow system in muddy south bank downstream from Cook Highway road bridge, J. C. Yaldwyn, 27/11/1963, one female carapace length 17 mm (Australian Museum P.18361). Port Curtis, M. Ward & W. Boardman, 1929, one female 22 mm (P.15058).

New South Wales: Hunter River, D. G. Stead, 23/4/1910, one female 25 mm (P.4746). Hawkesbury River, near Brooklyn, A. A. Racek, June 1956, one female 15 mm (P.12944). Careel Bay, Pittwater, near Sydney, from burrow in intertidal mangrove mud, A. Healy & J. C. Yaldwyn, Dec. 1967, one female 16 mm (P.15820). Parramatta River, Port Jackson, Haswell Collection, one male approx. 18 mm (P.15057). Hen and Chicken Bay, Parramatta River, near Sydney, from storm water channel under construction, M. E. Gray, 27/9/1935, 5 males 26-28 mm, 2 ovigerous females 27-28 mm (P.10725). Bonny Doon golf course, mouth of Cook's River, Botany Bay, from shore of muddy creek, J. J. Johnston, one female 26.5 mm (P.11578). Lugarno, George's River, near Sydney, in sandy mud, 21/12/1955, one ovigerous female 18 mm (P.13506). N.S.W. (no detailed locality), State Trawling Industry, 1920, one male 21 mm (P.15819).

Type Material

The holotype is the female (P.15820) from Careel Bay, Pittwater, now dissected, but recorded alive in both colour (Healy & Yaldwyn, 1970: frontispiece) and black and white photographs (pls VI & VII). The exact locality where the holotype was collected from a short, horizontal burrow roofed by a piece of wood was in soft mud among mangrove pneumatophores at the foot of the grey mangrove tree (*Avicennia marina*) on the left of colour plate 9 in Gillett and Yaldwyn (1969). The remainder of the material examined is all paratype. The holotype and the majority of the paratypes are in the Australian Museum (P. registration numbers) with two paratypes in the



Figures 8-12—*Laomedia healyi* Yaldwyn & Wear, holotype, adult female;
 Fig. 8, left 1st maxilliped; Fig. 9, left 2nd maxilliped; Fig. 10, left
 3rd maxilliped; Fig. 11, 1st pleopod; Fig. 12, 2nd pleopod.

Dominion Museum, Wellington (male from P.10725 = Z. Cr. 1897; P.11578 = Z. Cr. 1898) and two in the Rijksmuseum van Natuurlijke Historie, Leiden (male from P.10725; P.12944).

All measurements given in the material examined list are of carapace length only (from posterior corner of orbit to level of dorsal midpoint of hind margin of carapace) and thus exclude the rostrum. Figures 1 to 12 are all drawn from the holotype, while the formal description is based on the male P.15819 but is modified to cover all type material.

Description

A small-eyed, relatively-large, burrowing shrimp with stout, heavily-built and slightly unequal chelipeds.

The carapace is laterally compressed and shorter than the abdomen. Long and short setae present on many parts of the animal, distinct clumps of long setae present on chelipeds and laterally on carapace, but body and appendages are not covered with a short and dense "pile" of fine, fur-like setae as described for *Jaxea novaezealandiae*. A fine, rust-coloured layer partly or almost completely coats the exoskeleton in several of the specimens available. Where this layer is not present, or has been mechanically removed, the cuticle is firm, white (in preserved specimens), translucent rather than completely opaque, and smooth except for the hands which are minutely and evenly tuberculate. There is a very distinct *linea thalassinica* laterally on each side of the carapace forming a hinge line upon which each pterygostomiobranchial portion of the carapace can move. A distinct cervical groove is situated dorsally a little anterior to midpoint of carapace exclusive of rostrum, but does not extend ventrally across *linea*. Anterodorsal surface of carapace smooth and produced anteriorly as a depressed, flattened, slightly downcurved, bluntly rounded rostrum, armed on each side of a terminal tooth with about 3 to 6 small teeth. Anterodorsal margin of carapace with an orbital spine above origin of *linea thalassinica* and a smaller, antennal spine immediately below origin. There is a short ? branchiostegal groove, directed posteroventrally, below level of antenna; remainder of anterolateral and ventrolateral border smooth and unarmed.

Abdomen of uniform depth throughout; pleuron of 1st segment reduced and in life overlapping anteriorly the convex posterolateral margin of carapace at level of *linea*. Pleura of other segments broadly rounded, each overlapping posteriorly the next segment; pleuron of 2nd segment overlapping anteriorly the pleuron of 1st. Telson subquadrate with distal edge weakly convex, setose and unarmed; there is an indistinct, median, longitudinal groove dorsally and about 3 to 4 indistinct teeth at the midpoint of each lateral margin.

Eyes reduced, but not degenerate, extending laterally from beneath rostrum so that cornea is visible in dorsal view; cornea small, narrower than short flattened stalk, and entirely black.

Antennules arise close together under rostrum, which extends anteriorly beyond midpoint of 2nd segment of antennular peduncle but does not reach distal margin of 2nd segment (Note: articulation between 2nd and 3rd segments of antennular peduncle not shown in fig. 4). Second segment about half 3rd antennular peduncle segment. Antennular flagella about three and a half times 3rd segment; outer ramus with about 30-50 segments, subequal in length to more slender inner ramus. Peduncle of antenna 5-segmented (Note: right antennal peduncle damaged and flagellum missing in holotype, see fig. 4 and pl. VI); no segment greatly elongated; 4th or penultimate segment about one and a half times length of ultimate segment (not subequal as stated in "preliminary description"). Scaphocerite greatly reduced and extending anteriorly from dorsodistal margin of 2nd peduncle segment, rounded in outline, unarmed. Antennal flagellum ranging in length from a little less than twice carapace length (as in holotype) to about two and half times carapace length; bearing several (as many as 15 in some specimens), prominent, relatively-long, hair-like "branches" irregularly spaced along its length. These "branches", clearly seen in photographs of living animal (pls VI & VII upper), are rather stoutly built,

modified setae arising from individual antennal segments in a distinct, unevenly spaced, medioventral row along flagellum (as flagellum is thrown back over body in fig. 1, the "branches" appear to be "dorsal").

Mandible consists of molar process with a curved toothed ridge and a 2-segmented palp. First maxilla with two endites armed with stout bristles and setae medially, and a 2-segmented endopod with distal segment shorter and more slender than proximal. Second maxilla with two endites each partially divided into two, simple endopod and large scaphognathite with proximal lobe unusually long, tapering, truncate and bearing a long whip of setae. All three maxillipeds have long and prominent exopods, consisting of two parts, peduncle and flagellum, articulated at a distinct angle to one another; flagellum with single proximal segment nearly as long as, or as long as, multi-segmented portion. First maxilliped with 2 endites; 2-segmented endopod with distal segment irregularly enlarged, and large epipod. Second maxilliped with penultimate segment slightly expanded, with well developed podobranch and slender serrated epipod. Third maxilliped small and pediform, endopod of 5 segments with ischium bearing a prominent median crest of about 17 to 20 sharp teeth; complex epipod consisting of a small, curved, anterior lobe, a podobranch and a posteriorly directed, serrate-margined mastigobranch. Two arthrobranchs are present on 2nd and 3rd maxillipeds but only one on 1st.

Chelipeds strongly developed and heavily calcified, subequal in shape and form, but slightly unequal in size (right more often bigger than left); large cheliped about equal in length to carapace and 1st and 2nd or 1st to 3rd abdominal segments. Free finger relatively short, from two thirds to subequal with palm in length, stout and curved; inner or cutting edge, armed with one, enlarged, blunt tooth proximally but sharp and non-serrate distally; outer or convex edge, bearing a low crest of rounded tubercles almost concealed in setae along its length. Fixed finger short, broadly triangular, armed on cutting edge with one, main, low, broad-based tooth at middle and (varying from specimen to specimen) some secondary, blunt teeth and distal serrations.

Hand varying in length between about two thirds and three quarters of carapace excluding rostrum; hand length less than twice width; palm parallel-sided, rather than swollen, weakly angled proximally along dorsal margin and with a distinct, longitudinal, narrow crest of low, closely-spaced tubercles along full length of ventral margin extending onto ventral margin of fixed finger almost to tip. Carpus short, broad distally but abruptly narrowed proximally, unarmed. Merus rounded in lateral view, with flattened median face, maximum width more than three quarters length; unarmed dorsally but with proximal row of 5 or more, short teeth on narrow ventral margin. Ischium short, triangular and armed with a double row of short teeth along entire ventral margin culminating in two much stronger teeth distally. Basis short and unarmed. *Linea impressae*, or weakened and nearly transparent lines on the cuticle (presumably to facilitate moulting, cf. presence in alpheid shrimps), occur across inner distal face of hand (see fig. 2), diagonally across inner face of carpus, and on inner face of merus and ischium along both dorsal and ventral edges.

Second to 5th pereopods short, compressed and, except for dactyls and propodi, rather similar in structure. Second pereopod, unlike others, with fringe of setae along most of dorsal and ventral edges; dactyl flattened and blade-like, acute distally but otherwise unarmed, subequal to propodus; dactyl articulated to propodus so as to close with ventral edge against part of broad distal margin of latter and thus qualifying as "subchelate"; propodus subequal in length to carpus and with other segments of this appendage unarmed except for setal fringe; merus relatively broad, a little more than twice length carpus. Third and 4th pereopods similar; both limbs with dactyl slender, curved distinctly laterally (out of plane of appendage), acute distally, armed dorsally with an irregularly spaced (closer together proximally) row of about 8 or more short, stout teeth and armed ventrally for entire length with a curved, comb-like row of numerous, slender, closely-spaced teeth; dactyl subequal with propodus; carpus a little longer than propodus and a little more

than half merus (distinctly more than half merus in 4th); all segments except dactyls unarmed. Fifth pereopod more slender than others; propodus straight, but twisted in plane of appendage so that dactyl moves medially rather than ventrally; dactyl in both sexes slender, acute, depressed (i.e. flattened dorsoventrally in its original morphological plane), articulated with propodus so as to close with part of its flat ventral face against distal end of propodus, and armed for entire length of lateral edge with a comb-like row of short, closely-spaced teeth; propodus with bunch of slender spines on distal end which meet ventral face of dactyl when latter is in closed position, and with triangular patch of short, closely-spaced setae distally on outer surface; remainder of propodus and other segments unarmed; dactyl a little shorter than carpus, dactyl equal to half produs, and propodus subequal to merus.

First pleopods absent in male; reduced, uniramous, slender and setose in female. Second to 5th pleopods in both sexes similar, well developed, biramous, with exopod and endopod in each subequal, lanceolate and setose. No appendix interna or appendix masculina present. Uropods with exopod and endopod subequal in length and a little longer than telson; both exopod and endopod with transverse suture at about $\frac{2}{3}$ length of ramus and with row of short spines overlapping suture; a few inconspicuous spines on lateral edge of exopod immediately proximal to suture; each ramus with low, broad, longitudinal ridge in midline. Protopod of uropod with spined lobe overlapping base of endopod.

Opening of vas deferens in male on raised tubercle distomedially on coxa of 5th pereopod; oviduct opening in female medially on coxa of 3rd pereopod. Eggs very small and numerous on ovigerous female P.13506. Both male and female have triangular plate on thoracic sternite immediately behind base of 4th pereopods. This plate is oriented apex posteriorly, concave in transverse section with a longitudinal median groove which is deeper and narrower in the male.

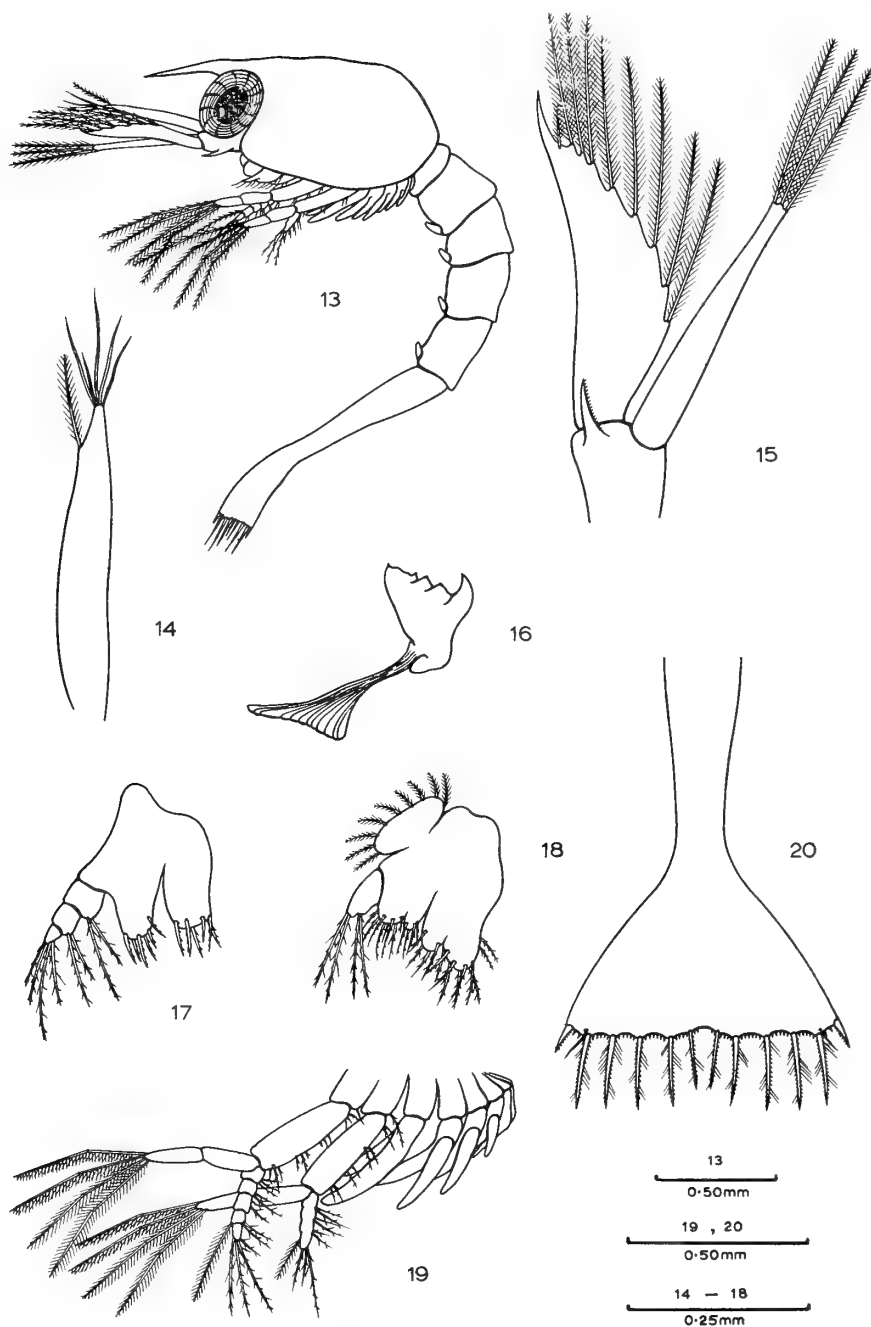
Branchial formula

	Maxillipeds			Pereopods				
	1st	2nd	3rd	1st	2nd	3rd	4th	5th
Pleurobranchiae	—	—	—	—	—	—	—	—
Arthrobranchiae	1	2	2	2	2	2	2	—
Podobranchiae	—	1	1	1	1	1	—	—
Epipodites	1	1	1	1	1	1	1	—
Exopodites	1	1	1	—	—	—	—	—

This formula agrees in complete detail with that established for *Jaxea novaezealandiae* and for *J. nocturna* Nardo by Wear and Yaldwyn (1966) and, except for the rudimentary podobranch on the first maxilliped discussed above, agrees in number with that published for *Laomedia astacina* by Sakai (1962). Our examination of *L. astacina* specimens from Japan gives the same detailed formula established here for *L. healyi*. As Chace (1939) records 18 gills for each of two species of *Naushonia*, it would appear that all examined adult species of the family Laomediidae have 18 gills though there is some minor differences in distribution between Chace's formula for *N. portoricensis* (Rathbun) and that established for the other five species.

Egg-carrying "formula"

Eggs in *L. healyi* are small (less than 0.5 mm in diameter), numerous, and carried on all five pairs of pleopods in the female. The number of pleopod pairs which carry eggs is called the "egg formula" by Sakai (1962). Both *L. astacina* and *Laomedia* n.sp. (Barron River) carry eggs on all five pairs of pleopods. Ovigerous females of *L. healyi* were taken in September and December (eyes visible within eggs), while the ovigerous female *Laomedia* n.sp. (Barron River) was taken in November (eyes visible).



Figures 13-20—*Laomedia astacina* de Haan, stage 1 zoea larva from Japan; Fig. 13, stage 1 zoea, lateral view; Fig. 14, left 1st antenna; Fig. 15, left 2nd antenna; Fig. 16, left mandible; Fig. 17, left 1st maxilla; Fig. 18, left 2nd maxilla; Fig. 19, 1st to 3rd maxillipeds and 1st to 5th pereopods, lateral view; Fig. 20, telson, ventral view.

Colour in life

Two specimens of *L. healyi* were examined alive. The holotype (for colour photograph see Healy & Yaldwyn, 1970: frontispiece) was a uniform pinkish-red dorsally with scattered pale areas along the edges of the carapace and at the articulation of some cheliped segments, and much paler (almost white in places) ventrolaterally, ventrally and on the walking legs and pleopods; eyes black. The female *L. healyi* (P.18361) from Barron River, north Queensland, taken in the same area as the yellow *Laomedea* n.sp. (Barron River) was dark pinkish-red (almost purplish-red) on the dorsal surface of the body and chelipeds with the ventral surface much paler in colour.

Notes on burrowing

Laomedea healyi is a burrowing animal as all thalassinid shrimp appear to be. Unlike the case of the subtidal *Jaxea novaezealandiae* (see Wear & Yaldwyn, 1966: 11), where burrowing was assumed from indirect evidence such as general facies, diurnal/nocturnal collecting ratios and behaviour in laboratory aquaria, burrow living in *L. healyi* has been directly observed. The holotype was taken from a short burrow in soft mud roofed over by a piece of timber, while the Barron River *L. healyi* was dug from a complex crab burrow system, many feet underground. The seven large specimens from Hen and Chicken Bay, Parramatta, were found during the construction of a storm water channel and were presumably dug from burrows.

Observations on living animal.

The holotype was kept alive for several days in an aquarium by Anthony Healy, one of its collectors. In captivity it was markedly thigmotactic and negatively phototropic, but did not turn away from light very vigorously. The cornea was small, intensely pigmented and clearly photosensitive. The eye-stalk projected out from under the rostrum in dorsal view. The animal was an active walker but never attempted to swim in any way. When disturbed it was capable of violent backward movement by a sudden flexure of the abdomen and telson. The pleopods were in almost constant motion, beating with a metachronal rhythm at different speeds depending on the activity of the animal. The distinctive hair-like "branches" on the antennal flagellum hung limply down medioventrally and were not seen to move independently of the flagellum. When in poorly aerated water the sides of the carapace, ventral to the *linea thalassinica*, could "pant" quite vigorously out of phase with each other at a rate of about two in and out movements per second. The "panting" movement originated from the *linea* which acted as a hinge line for the pterygostomio-branchial portion of the carapace on each side of the animal.

PART 2. NOTES ON LARVAE OF THE GENUS *LAOMEDIA*

Since our previous publication on thalassinid Crustacea (Wear & Yaldwyn, 1966), the authors have given serious consideration to the possibility that larvae of the unknown eastern Australian species of *Jaxea* described from Sydney Harbour by Dakin and Colefax (1940: 179-182) may in fact belong to *Laomedea healyi*. This possibility is supported by circumstantial evidence, as only two laomediid larval series have been found in the eastern Australian plankton, and one of these can certainly be attributed to the genus *Naushonia*. The remaining larval series, identified as larvae of *Jaxea* by Dakin and Colefax, could well have been linked with *Laomedea healyi* which is the only adult laomediid shrimp known from the eastern Australian region.

More recently, first stage zoea larvae of *Laomedea astacina* from Japan have been hatched and recorded by Sakai and Miyake (1964). This work became known to us after our 1966 paper went to press, and provided the first opportunity to establish the identity of larvae of the genus *Laomedea* with certainty. These larvae differ greatly from those of *Jaxea* (including the Dakin and Colefax series), *Naushonia* and other laomedids, and without

the positive identification now available, they would be classified as upogebiid larvae rather than larvae of the family Laomedidae.

We are greatly indebted to Dr. Sakai for sending us this larval material and for his permission to publish a complete description of the first stage larva of *Laomedea astacina*.

Description of First Zoea of *Laomedea astacina* de Haan

Total length of larva 3.25 mm (measured from tip of rostrum to posterior telson margin excluding setae); carapace length including rostrum 1.20 mm; rostrum slender and unarmed, tapering to a point and extending well beyond the level of the unstalked eyes (fig. 13); region between mouth and antennae not lengthened, and there is no evidence of a "neck".

First antenna (fig. 14) uniramous, unjointed, and bearing five terminal aesthetascs and one subterminal biplumose seta on its inner margin. Second antenna (fig. 15) with protopod bearing one large, finely toothed ventral spine; endopod with three long biplumose setae arising from its tip; squamous exopod slightly longer than endopod and with its tip smooth and acicular, inner margin armed with eight long biplumose setae and one much smaller seta.

Left and right mandibles almost symmetrical, with incisor process of left mandible only slightly extended (fig. 16); left and right paragnaths symmetrical as is normal among decapod larvae other than *Jaxea*, *Naushonia* and related forms, and left paragnath not produced into a sickle-shaped process. First maxilla (fig. 17) with proximal and distal endites each bearing six marginal plumose setae arranged as illustrated; endopod three-segmented, first and second segments each bearing two sparsely plumose setae, terminal segment with four such setae. Second maxilla (fig. 18) with first (proximal), second, third and fourth (distal) endites having ten, four, four and eight marginal plumose setae respectively; endopod a single segment with four such setae; scaphognathite rudimentary, with eight or nine small biplumose setae spaced along its margin.

First maxilliped (see fig. 19) with one seta arising from posterior margin of coxa; basis with 12 setae arranged in four groups of three setae along inner margin; endopod of five segments each of about the same length and provided with setae as illustrated; exopod of two segments, slightly longer than endopod, and with four biplumose, natatory setae arising from its tip. Second maxilliped similar to first, but endopod here incompletely divided into four segments each bearing setae as illustrated in fig. 19. Third maxilliped biramous and with exopod a little longer than endopod; both rami unsegmented and lacking setae; endopod arises from near base of basipod. Pereiopods all present as unsegmented rods; first to third pereiopods each with a rudimentary exopod; fourth and fifth pereiopods without exopod buds (fig. 19). Gill buds are not developed in the first stage zoea larva.

Abdomen (fig. 13) consists of five segments and a telson; sixth segment and telson are not separate; abdominal segments unarmed and lacking procurved pleural hooks; bud-like pleopod rudiments occur ventrally on segments two to five. Telson (fig. 20) spatuliform, almost straight across the posterior margin, and with a very indistinct posterior cleft. Posterior telson margin armed with numerous small teeth and seven pairs of setae: first (outer) seta very short and stout, articulating with telson plate, and finely serrated along its inner margin; second seta reduced to a fine hair as is usual among thalassinid larvae; third to sixth setae about equal in length, finely serrated along their inner and outer margins, and with scattered fine lateral hairs; seventh (inner) seta smaller than third to sixth pairs, but otherwise similar to these.

Later Larval Stages

Several first stage larvae of *Laomedea astacina* showed a second larval stage beneath the cuticle. In this second stage the inner ramus of the first antenna is developed and is separate from the peduncle, pereiopods are strongly developed, and the sixth abdominal segment is divided from the telson which

bears nine pairs of posterior setae. Biramous uropod buds are present. It was not possible to observe further detail.

These characters are those of the third or later larval stages in *Naushonia* (Dakin & Colefax, 1940: 179) and in *Jaxea* (Wear & Yaldwyn, 1966: 17; Caroli, 1924) and it seems likely that there are fewer larval stages in the life history of *Laomedea astacina* than in either *Naushonia* with six stages or *Jaxea* with six or occasionally seven stages.

Discussion

There are many larval characters previously thought to be characteristic of the family Laomedidae, and present in the larvae of *Jaxea*, *Naushonia* and in laomediid larvae of unknown parentage (Gurney, 1924: 156; 1938: 334-338), which do not appear in *Laomedea astacina*. A comparison of larval characters of the three genera *Jaxea*, *Naushonia* and *Laomedea* reads as follows:

- 1—There are six larval stages in *Jaxea* and *Naushonia*, but probably only four stages in *Laomedea*.
- 2—In *Jaxea* the region between the antennae and the mouth is greatly exaggerated in length, and the larvae are very long and slender. Larvae of *Laomedea* have no such "neck", are much stouter than those of *Jaxea*, and are rather similar in general facies to larvae of other thalassinid groups, especially those of the Upogebiidae. *Naushonia*, and an apparently related form (Gurney, 1938: 334-337, figs 36, 37), represent an intermediate stage between these two extremes of development.
- 3—The rostrum is much reduced in both *Jaxea* and *Naushonia*, but in *Laomedea* it is well developed and extends forward well beyond the level of the eyes.
- 4—In *Jaxea* and *Naushonia* the pleura of the second to fifth abdominal segments, and often also of the first segment, are extended as procurved hooks. *Laomedea* lacks these pleural processes in stage one, but these structures may appear in later larval stages.
- 5—In the first larval stage of *Jaxea*, the widely forked telson is deeply cleft and the two rami are long and slender. In *Laomedea*, the telson is spatuliform in stage one, and almost straight across the posterior margin. *Naushonia* possesses a telson intermediate between these two shapes in stage one.
- 6—The left mandible and paragnath of *Jaxea*, *Naushonia* and all other larvae so far attributed with certainty to the family Laomedidae, are both drawn out into a sharp sickle, but in *Laomedea* these structures are unmodified as in other thalassinid larvae.
- 7—The endopod of the first maxilla is unsegmented in *Jaxea* and *Naushonia*, but three-segmented in *Laomedea* as is the case in *Upogebia*.
- 8—The endopod of the second maxilla is reduced in *Jaxea* and *Naushonia*, but is not reduced in *Laomedea*.
- 9—In all three genera the endopod of the third maxilliped arises from near the base of the basipod as in *Upogebia* and the Anomura.
- 10—Other distinctive characters of the first stage larva of *Laomedea astacina* (such as the presence of well developed pereopods with exopods, and the presence of pleopod buds) are features relating to the degree of development on hatching, and cannot therefore be used as features of difference from the stage one larvae of *Jaxea* and *Naushonia* in which these characters appear in later larval stages (Caroli, 1924; Dakin & Colefax, 1940; Wear & Yaldwyn, 1966). However, exopods occur on pereopods one to three as in the Upogebiidae (Gurney, 1942: 246-249) and there is no exopod on the fourth or fifth pereopods. *Jaxea*, *Naushonia* and all other laomediid larvae possess an exopod on the fourth pereopod in later larval stages, but it is rudimentary in *Jaxea*.

While the larvae of *Laomedea astacina* are undoubtedly related to those of *Jaxea*, *Naushonia* and described laomediid larvae of unknown parentage,

they effectively bridge the gap between these previously described laomediid larvae and those of the Upogebiidae. It is also evident that the larvae of *Laomedia astacina* share more larval characters with the Upogebiidae than they do with other laomediid larvae. This is further evidence of close relationship between the Upogebiidae and the Laomedidae, which together form an "anomuran" larval group within the Thalassinidea (Gurney, 1938: 339-343). A further point of interest is that larvae of *Naushonia* can be placed between *Jaxea* which shows extreme development of such exclusively laomediid larval characters as the long "neck", procurved pleural hooks, and sickle-shaped mandible and paragnath, and *Laomedia* in which these characters are not developed or are restricted in their degree of development.

Several unidentified laomediid larvae (Gurney, 1938: 334-338) are similar to those of *Upogebia* and *Laomedia astacina* in general form, but possess asymmetrical mandibles and paragnaths, and have an unsegmented endopod on the first maxilla as in *Jaxea* and *Naushonia*. A larval series described by Menon (1933) and attributed to the "Upogebinae", is rather similar to the larva of *Laomedia astacina*, but can be excluded from both the Upogebiidae and Laomedidae as the post-larval stage of Menon's species possesses an appendix interna on the pleopods. However, Gurney (1924: 156, fig. 62) recorded a stage three larva from off Three Kings Islands, northern New Zealand, which has larval characters one would expect to occur in a comparable larval stage of a second species of the genus *Laomedia*. It is therefore quite possible that an adult *Laomedia*, even perhaps *L. healyi*, occurs in the soft mud of the poorly investigated and extensive mangrove swamp areas of northern New Zealand.

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OBSERVATIONS ON A BREEDING POPULATION OF *DANAUS PLEXIPPUS* (L.) (LEPIDOPTERA: NYMPHALIDAE) AT CAMDEN, NEW SOUTH WALES

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INTRODUCTION

As an adjunct to studies on the population movements of *Danaus plexippus* (L.) (Wanderer Butterfly), observations were made on a breeding population at a site in the Razorback area, near Camden, New South Wales, from mid-1963 to the end of 1967. Although this species breeds in many parts of Australia, the Razorback site was chosen because of its heavy stand of Milkweed (Swan Plant) (*Gomphocarpus fruticosus*), one of the main food plants of Wanderer larvae, and because of its proximity to two localities at which the butterflies were known to gather in overwintering clusters (Smithers, 1965). One of the aims of the observations was to follow population development through the year. This was done by periodically counting eggs, larvae and adults. Pupal counts could not be made owing to the difficulty of finding pupae in the field, although at times there must be large numbers present.

The area of observation consisted of a large night holding paddock for a herd of dairy cattle. The eastern end was flat and grassy without milkweed; the western end sloped up a steep hillside on the lower slopes of which milkweed was abundant. The milkweed extended in a broad, irregular band across the south-eastern, eastern and north-eastern lower slopes of the hill.

The strip of milkweed was divided into twenty-five plots each ten yards wide and extending up the slope as far as the milkweed extended, which was as much as one hundred and twenty-five yards. The long side of the plots thus ran up and down the slope.

Counts were made on the dates indicated in Tables I and II, the first observations being on 30th June, 1963 and the last on 14th December, 1967; 96 counts were made between these dates.

On each visit, ten plants were examined on each plot and the number of eggs and larvae on the top two feet of the plant recorded. Plants for examination were chosen by walking up the slope from the lower end of the plot and examining the plant nearest to the observer at ten pace intervals. Direction was altered after each examination. Thus, on each visit, two hundred and fifty plants were examined for eggs and larvae. In order to obtain some idea of the relative numbers of adults, the number of butterflies crossing a fifty yard line at the northern end of the observation area in half an hour was recorded, always between 11.30 a.m. and 12 noon. Adults flying in both directions were counted; where an individual remained in sight and crossed the line several times in quick succession it was recorded only once. Temperatures during adult counts were noted as well as general weather conditions and condition of host plants on each plot. The numbers recorded are given in Tables I and II.

Eggs are easily found and the counts for these can be considered accurate. Larger larvae are easily found, but first instar larvae were usually hidden in the developing small leaves at the ends of shoots and had to be searched for. It is likely that a proportion of first instar larvae were missed. Weather conditions affect adult flight activity; some low counts were clearly due to overcast or raining weather (e.g. that of 2nd February, 1967) with adults frequently being put up in the plots but few being counted in flight.

Butterflies were marked and released using the method described by Urquhart (1960).

It should be borne in mind that the comments in this paper refer only to the Razorback area; the breeding activities of *D. plexippus* vary considerably over its wide range in Australia.

RESULTS

Breeding Period

In broad terms it can be said that breeding takes place from early September to March. There is, of course, variation from year to year, probably dependent on climatic factors but also certainly influenced by host plant condition (see below). For example, the 1964-65 season was a short one, breeding starting late (November) and finishing a little earlier (February) than other years, although it is possible that there was some oviposition prior to the first positive count on 11th November, 1964. Also, occasionally late instar larvae can be found in the area well into winter on old plants or on a few plants in especially favoured situations, such as in protected pockets near the wall of a dam. Such late larvae are usually very dark specimens, the areas of black colouration being much more extensive than usual.

Number of Generations

Examination of Table I suggests the following annual cycle of generations. Pale overwintered adults arrive at the breeding site in small numbers in about early September, lay eggs and die or move on. Individuals marked at the site have not been recaptured there. Small numbers of larvae are found, but adults are not as numerous, until there is another increase of adults and eggs about two months later (November-December); these adults are fresh specimens, very different from old overwintered ones. These adults are probably the progeny of the over-wintered generation and represent the first new season emergence. It is not, of course, suggested that all developed on the actual observation site; most of them probably come from other breeding sites. As Wanderers are fairly long-lived as adults many of the progeny of this first summer generation emerge before all their parents have died. There is thus an overlap between the first and second generations and a general build-up of population through the season with the second generation emergence taking place mainly in late January-February. The larvae from eggs laid by the second generation give rise to adults of the third generation which overwinter or move out of the area to continue breeding elsewhere. The third generation does not lay extensively at the site on which it was bred.

Effects of host plant condition

Females readily oviposit on plants which are in healthy growth and will do so on any-sized plant from seedlings to well grown specimens of seven feet or more. Young larvae ascend to the growing points to feed. Maturity, or wilting due to drought, makes plants less attractive to ovipositing females. They have frequently been observed going from plant to plant but laying only on those with fresh growth, although the eggs are usually deposited on a large leaf and not necessarily at the growing apex of a shoot. Maturation of large numbers of plants (as indicated by seedpod formation) took place in early February in 1964, in mid-January in 1965, in late January in 1966 but not until about late March in 1967. Dramatic drops in egg counts and disappearance of adults took place at the same times. This was particularly noticeable in 1964 when most of the plants matured at once and very rapidly. Oviposition came to an abrupt halt although there were large numbers of females flying over the plants for a while before they, too, disappeared (see counts for 16th January, 6th February and 20th February, 1964). Maturation,

as in many plants, seems to be accelerated by reduction of water supply, hence drought conditions reduce population by both reducing oviposition and by making plants unsuitable for feeding to young larvae.

Distribution of eggs by females

The plots on which counts were made formed a series running from the south-eastern, through the eastern, to the north-eastern slopes of the hill. Table II gives the numbers of eggs and larvae for each count with the whole length of the count area divided into five plots, that is, the counts for plots 1-5, 6-10, 11-15, 16-20 and 21-25 have been added in each group. It will be seen that the females showed a marked preference for laying on the easterly to north-easterly aspects of the hillside. On only one occasion were appreciable numbers of eggs found on the south-easterly fifth of the site (16th January, 1964); in fact, over four years, less than 5% of the eggs and 3% of the larvae occurred in that area. The reason for this selection by ovipositing females is presumably climatic and dependant on insolation or temperature. The possibility that the areas chosen were less exposed to strong winds which might have deterred females should not be overlooked. At present there is no explanation for the obvious choice of some plots rather than others.

Relation of clusters to breeding population

It was originally assumed that the specimens arriving at the breeding site at the beginning of the season and from which the spring larval population was derived came from the nearby over-wintering clusters and that the clusters were made up of locally bred specimens. The available evidence (Tables I and III) does not confirm this.

There is always a period, usually of some weeks, between dispersal of the clusters and commencement of breeding when butterflies cannot be found at the cluster site nor free flying in numbers at the breeding site. When the clusters disperse, host plants are not available for oviposition at the breeding site, having mostly died back during the winter. There is also a similar period between cessation of breeding and cluster formation. Individuals marked at the breeding site or by co-operators in other parts of the Camden area have not been recaptured in the clusters. Individuals marked in the clusters have not been recaptured at the breeding site but some have been taken many miles from it.

The size of clusters bears little relation to the size of the previous or subsequent breeding population. There were large clusters in the winter of 1963, followed by a large breeding population. The 1964 winter clusters were small and dispersed early (before the end of May, 1964) and were followed by a small breeding population. There were no clusters in 1965 but the 1965-1966 breeding population was nevertheless large. Despite this, there was again no clustering in the 1966 winter but the following breeding season produced another large population (1966-1967). The 1967 clusters were fairly large. Clearly, a large breeding population at the observation site does not necessarily mean that large clusters will follow. Nor does it need a large cluster to ensure a large breeding population the following season; a few females from elsewhere can establish this.

It would seem, then, that the clusters are made up of individuals from elsewhere and that the breeding population is established in the spring by incoming females which have over-wintered elsewhere.

DISCUSSION

Wanderer populations in the Razorback area are established each year by incoming, over-wintered females from elsewhere. Development of larval populations is dependant on the presence of actively growing host plants;

when these mature or become unsuitable because of wilting due to drought, oviposition ceases and the adults move out of the area. Clusters of overwintering adults at sites near the breeding area are probably not derived directly from locally bred specimens but made up of individuals from elsewhere. It is, of course, possible that some of these may be locally bred specimens which had moved away previously. There is, thus, an established seasonal pattern of population movement to and from the clustering site and to and from the breeding site; the latter pattern appears to be determined largely by host plant condition.

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TABLE I

BREEDING POPULATIONS OF *DANAUS PLEXIPPUS* IN THE
RAZORBACK AREA

Date	Eggs	Larvae	Adults	Date	Eggs	Larvae	Adults
4 visits made from 30.6.63 to 4.9.63 without finding immature stages, no adults; adults at cluster site until 18.7.63				31.8.65	11	—	2
20.9.63	12	—	41	16.9.65	8	—	—
3.10.63	1	3	29	28.9.65	18	3	—
17.10.63	—	1	5	26.10.65	3	6	—
6.11.63	—	3	5	9.11.65	6	4	2
20.11.63	—	1	25	24.11.65	44	22	—
4.12.63	17	9	80	9.12.65	20	5	7
18.12.63	30	19	66	20.12.65	30	7	7
2.1.64	18	11	68	30.12.65	107	12	9
16.1.64	134	10	80	13.1.66	45	19	27
6.2.64	7	35	78	27.1.66	53	6	6
20.2.64	10	—	6	10.2.66	—	—	5
4.3.64	4	3	25	23.2.66	6	3	13
15 visits were made from 19.3.64 to 25.10.64 one larva seen on 20.5.64; only occasional adults seen; adults present at cluster site from 2.4.64 to 6.5.64				17.3.66	4	4	2
11.11.64	5	4	2	5 visits were made from 29.3.66 to 27.7.66 without finding immature stages; no adults seen; a few specimens present at clustering site.			
26.11.64	3	7	5	6.9.66	12	—	2
9.12.64	19	13	9	21.9.66	6	—	5
22.12.64	21	5	6	6.10.66	2	9	2
7.1.65	20	15	4	25.10.66	—	11	1
21.1.65	3	8	5	15.11.66	3	5	16
2.2.65	1	1	1	18.12.66	43	14	40
22.2.65	4	—	3	4.1.67	32	7	30
8 visits were made from 4.3.65 to 10.8.65 on only one of which were 2 larvae found; no adults seen; 2 specimens only during this period at clustering site				2.2.67	37	12	7
				22.2.67	9	2	62
				22.3.67	43	22	47
				20.4.67	3	—	5
				13 visits were made from 23.4.67 to 17.8.67 without immature stages; no adults seen; adults present at cluster site from 20.4.67 to 17.8.67.			
				15.9.67	13	—	—
				28.9.67	3	—	—
				13.10.67	1	1	—
				10.1.67	—	—	—
				28.11.67	7	—	3
				14.12.67	4	2	5

TABLE II
DISTRIBUTION OF EGGS AND LARVAE IN OBSERVATION AREA—
DANAUS PLEXIPPUS

EGGS							LARVAE						
Plot Nos.							Plot Nos.						
	1-5	6-10	11-15	16-20	21-25	Total		1-5	6-10	11-15	16-20	21-25	Total
20.9.63	1	—	3	3	5	12	—	—	—	—	—	—	—
3.10.63	1	—	—	—	—	1	—	1	—	2	—	—	3
17.10.63	—	—	—	—	—	—	—	—	1	—	—	—	1
6.11.63	—	—	—	—	—	—	—	—	1	—	—	2	3
20.11.63	—	—	—	—	—	—	—	—	—	—	1	1	1
4.12.63	—	3	5	5	4	17	—	—	—	2	7	9	9
18.12.63	1	4	4	10	11	30	2	2	3	4	8	19	19
2.1.64	3	2	—	13	—	18	—	1	1	8	1	1	11
16.1.64	17	20	37	27	33	134	1	2	4	2	1	1	10
6.2.64	—	1	—	—	6	7	1	2	7	20	5	35	35
20.2.64	—	1	2	2	5	10	—	—	—	—	—	—	—
4.3.64	—	2	—	1	1	4	—	1	—	—	2	3	3
11.11.64	1	—	2	2	—	5	1	—	—	2	1	4	4
26.11.64	—	—	1	1	1	3	—	1	—	4	2	7	7
9.12.64	3	2	1	8	5	19	2	1	—	6	4	13	13
22.12.64	5	4	2	3	7	21	1	1	1	—	2	5	5
7.1.65	5	5	3	1	6	20	3	3	—	2	7	15	15
21.1.65	—	3	—	—	—	3	—	1	4	—	3	8	8
2.2.65	1	—	—	—	—	1	—	—	1	—	—	1	1
22.2.65	—	2	—	—	2	4	—	—	—	—	—	—	—
4.3.65	—	—	—	—	—	—	—	—	—	1	1	2	2
31.8.65	—	1	1	4	5	11	—	—	—	—	—	—	—
16.9.65	—	1	5	2	—	8	—	1	1	1	1	3	3
28.9.65	—	—	4	10	4	18	—	—	1	1	1	3	3
26.10.65	—	—	—	1	2	3	—	—	—	5	1	6	6
9.11.65	—	—	1	1	4	6	—	—	1	—	3	4	4
24.11.65	2	2	14	19	7	44	1	1	5	6	9	22	22
9.12.65	—	1	12	5	2	20	—	—	2	2	1	5	5
20.12.65	—	4	13	7	6	30	—	1	4	1	1	7	7
30.12.65	—	10	28	44	25	107	—	2	2	7	1	12	12
13.1.66	—	9	8	19	9	45	—	2	10	4	3	19	19
27.1.66	—	9	34	5	5	53	—	1	3	—	2	6	6
10.2.66	—	—	—	—	—	—	—	—	—	—	—	—	—
23.2.66	—	—	5	—	1	6	—	—	1	2	—	3	3
17.3.66	—	—	1	3	—	4	—	—	1	—	3	4	4
6.9.66	—	2	3	5	2	12	—	—	—	—	—	—	—
21.9.66	—	1	5	—	—	6	—	—	—	—	—	—	—
6.10.66	—	1	—	1	—	2	—	5	4	—	—	9	9
25.10.66	—	—	—	—	—	—	—	—	5	4	2	11	11
15.11.66	—	1	—	—	2	3	—	—	5	—	—	5	5
18.12.66	—	18	11	5	9	43	—	4	2	1	7	14	14
4.1.67	—	6	14	1	11	32	—	2	1	2	2	7	7
2.2.67	—	12	6	5	14	37	—	3	2	4	3	12	12
22.2.67	—	1	—	5	3	9	—	—	1	—	1	2	2
22.3.67	—	6	—	16	21	43	—	8	1	5	8	22	22
20.4.67	—	—	1	—	2	3	—	—	—	—	—	—	—
15.9.67	—	11	2	—	—	13	—	—	—	—	—	—	—
28.9.67	—	—	—	2	1	3	—	—	—	—	—	—	—
13.10.67	—	1	—	—	—	1	—	—	—	1	—	1	1
10.11.67	—	—	—	—	—	—	—	—	—	—	—	—	—
28.11.67	—	1	2	3	1	7	—	—	—	—	—	—	—
14.12.67	—	—	2	2	—	4	—	—	—	2	—	2	2
	40	147	232	241	222	882		12	45	74	100	95	326

TABLE III

APPROXIMATE DATES OF CLUSTERING AND BREEDING PERIODS—
DANAUS PLEXIPPUS

Cluster dispersal	Start of breeding	End of breeding	Cluster formation
18.7.63	20. 9.63	4.3.64	2.4.64
6.5.64	11.11.64 (or earlier?)	22.2.65	None
—	31. 8.65	17.3.66	None
—	6. 9.66	22.3.67	20.4.67



Tom Iredale,
1940.



Tom Iredale
in the
Kermadec
Islands,
1908.

Tom Iredale (1880-1972).



Plate VI. *Laomedia healyi* Yaldwyn & Wear, holotype alive, dorsal view; New South Wales. Right antennal flagellum missing.

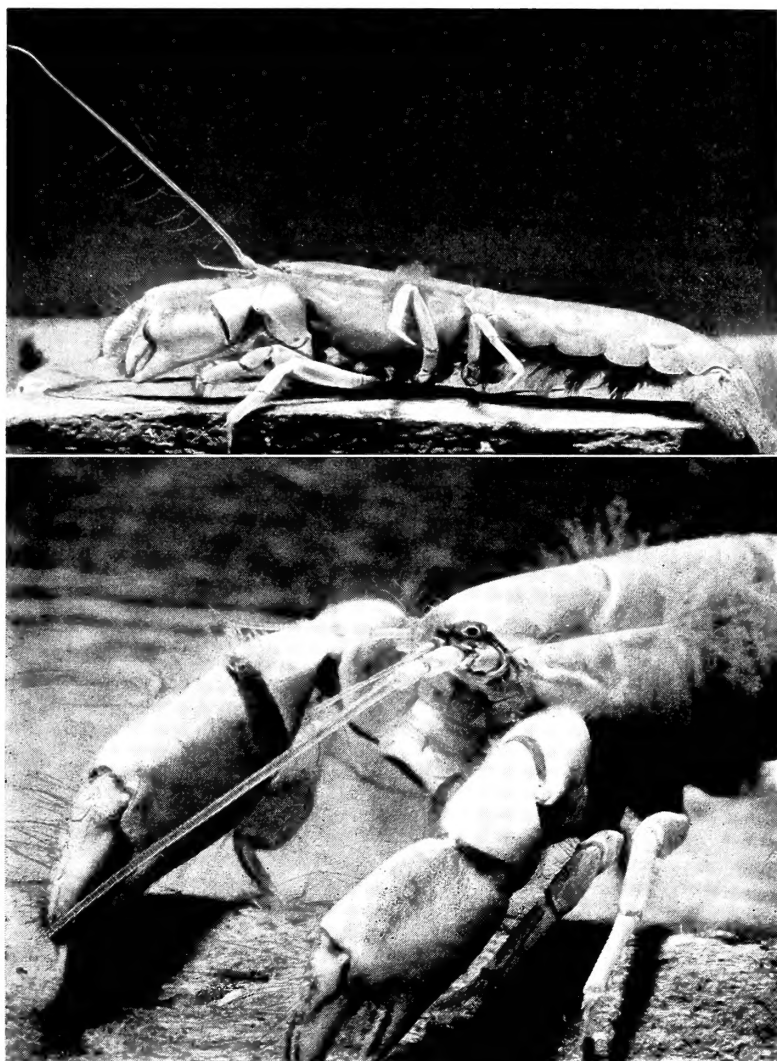


Plate VII upper. *Laomedia healyi*, holotype alive, lateral view.

Note "branches" on antennal flagellum.

Plate VII lower. *Laomedia healyi*, holotype alive, anterolateral view. Note small but functional eyes.

(All photos of the holotype alive were taken in black and white, and also in colour, by A. Healy).

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